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A New Method of Sinking Shafts.

By Eckley B. Coxe.*

I desire to call the attention of the Institute to two deep vertical shafts, which are now being sunk in Schuylkill County, Pennsylvania, about 1½ miles north of Pottsville. These shafts are of interest to the mining engineer, not only on account of the novelty of the method of sinking adopted, which promises to produce a revolution in that branch of mining engineering, but also as examples of the manner in which such work should be undertaken.

Geological Sketch of the Territory to be Worked by the Shafts and Reason for Sinking Them.

The Mammoth or E vein of the anthracite coal measures in that part of the Schuylkill region near and north of the town of Pottsville lies at a great depth below the surface and has, in consequence, never been worked in that locality.

The mammoth vein itself is about twenty-three feet thick, but, as is shown in the following sections, it is overlaid by the seven foot vein, which is separated from it by from 4 to 30 feet of rock and slate, so that the two together form a vein of about thirty feet in thickness.

Beechwood Colliery.

Seven Feet Vein..	8′.0″ coal, 0′.3″ slate, 6′.8″ coal, 0′.6″ slate, 2′.4″ coal,	Seven ft. Vein, Coal, 17′.0″ Refuse, 0′.9″	17′.9″
	10′.0″ slate,	Partition slate.	
Mammoth Vein,	6′.0″ coal, 0′.7″ slate, 7′.6″ coal, 2′.4″ coal, 0′.9″ slate, 2′.6″ coal, 5′.0″ rough coal	Slate 1′.4″ Coal 23′.4″ Total 24′.8″	

Recapitulation.

Seven Feet Vein	17′.0″ coal,	0′.9″ refuse,
Mammoth Vein	23′.4″ “	1′.4″ “
Total coal	40′.4″	2′.1″
Total refuse	2′.1″	
Total	42′.5″	

At Pine Forest Shaft Colliery:

Seven Feet Vein.....6′.0″ coal,
Slate.....15′.0″ to 20′.0″
Mammoth vein.....20′.0″ coal.

North of “Deep Shafts” the slate separating the Seven Feet and Mammoth Veins varies from 10 to 30 ft. in thickness.

At Hickory Shaft Colliery:

Seven Feet Vein averages .... 6′.0″ to 8′.0″ coal,
Slate.....10′.0″ to 10′.0″
Mammoth.....20′.0″ to 24′.0″ coal.

Section of Seven Feet (called No. 2 Vein) and Mammoth Veins, near Shenandoah.

Shenandoah City Colliery:

No. 2, or Seven Feet Vein	Top slate and rock: Coal, 4′.0″ slate, 0′.2″ coal, 3′.0″ slate, 1′.0″ coal, 2′.4″ slate, 1′.0″ coal, 2′.0″	Dip 20° S.
	13′ 6″	
	Bottom slate.	

Mammoth Vein	Slate between No. 2 and Mammoth Vein, sometimes rock: 0′.9″ coal 1′.0″ sulphur balls, 3′.6″ good, bright coal, 3′.8″ “ coal, containing a small streak of bone, 0′.5″ “charcoal bench,” soft, dull, sandy fracture, 0′.3″ coal, 0′.1″ slate, 3′.6″ good, bright coal, 6′.0″ “ “ “ “5 ft. bench,” 0′.8″ slate, 3′.0″ good, hard, bright coal, “3 ft. bench,” 0′.8″ bone, 7′.4″ very fine coal, “7 ft. bench,” 1′.0″ coal, bone and sulphur, “sulphur bench,”	
	31′.10″	
	Bottom slate.	
Plank Ridge Colliery:		
Mammoth Vein	1.0″ coal, 0′.5″ sulphur balls,	Not worked.
	2′.0′ good coal, a little rough, 3′.5″ very good coal, 2, 2″ good coal, a little rough, 0′.5′ bone and slate, 1′ 4′ good, bright coal, 1′.4″ “charcoal bench,” 5′.6″ good coal, cubical fracture, “5 ft. bench.” 0′.7″ bone and slate, 3′.0″ very good coal, “3 ft. bench,” 0′.7″ bone, 7′.5″ very good coal, cubical fracture, “7 ft. b'ch.”	
	29′.2″	
	Bottom slate.	
Mammoth Vein	4′.8″ very good coal, 0′.6′ bone, 2′.8′ good coal, 5′.0′ “ “	No. 2 Vein.
	1′.1″ slate, 2′.8″ good coal, 0′.6″ slate, 6′.0″ good coal, 0′.3″ bone, 4′.9″ good coal, 0′.6″ charcoal bench, 3′.6″ good coal, 6′.0″ “ “ “5 ft. bench,” 3′.6” coal with several seams of bone, “3 ft. b'ch.” 0′.6″ bone, 8′.0″ splendid coal,	
	51′.1″	
	Bottom slate.	

The Philadelphia and Reading Coal and Iron Company own a large tract of land in that vicinity which was formerly the property of two companies, in which the Philadelphia and Reading R. R. Co. owned a controlling interest; within a year it has passed into the hands of the former company, which is really a department of the Philadelphia and Reading R. R. Co.

Fig. 1 is a cross section of the property to be worked by the shafts at the point where they are to be sunk. Although the section may not be strictly accurate, the general structure of the basins is correct. Engineers familiar with the locality do not agree as to the exact position and number of the veins above the Mammoth vein. There are three principal basins, E, C and D, Fig. 1, to be reached by these shafts; they are separated by the two anticlinal axes or saddles A and B, the first of which, A, deepens to the west, and the other, B, rises for a certain distance to the east, and then sinks so that it is probable that gangways or levels through which the water will drain to the shafts, can be driven in coal from C into the two basins E and D. It is proposed to sink to the bottom of basin C and in this manner an area of the big vein will be opened 1500 yards wide and at least 4 miles long, provided it should prove economical to extend the workings so far.

* A Paper read at the meeting of the American Institute of Mining Engineers held May 21st, 1872.

Mr. FRANKLIN B. GOWEN, shortly after he was elected President of the Philadelphia and Reading R. R. Co., determined to make this large body of land available for the production of coal, the upper or red ash veins having been worked out, and the land, to a certain extent, abandoned. He saw that it would involve a great outlay of money, and that it would take a long time to open the property, but he also saw that a colliery could be erected capable of producing daily a very large amount of coal for a long series of years. Before beginning operations, Mr. HENRY PLEASANTS, the engineer selected to take charge of the work, made a careful study of the whole problem, the results of which were embodied in several reports to the company. He worked out the geological structure of the ground both by an examination of the surface indications and of the old workings so that the most favorable position for the location of the openings could be determined. There was no useless delay but many months were devoted by him to the consideration of the various questions which would be likely to arise and a large number of surveys both above and below ground were made. When the preliminary studies had been completed the work was begun and has been pushed rapidly to what promises to be a successful completion. This undertaking differs in this respect from most of the mining enterprises that have been started in the United States. We generally begin operations without fully understanding all that is to be done, and then solve as best we can any problems that may present themselves during the progress of the work. The latter mode of proceeding involves, of course, very often, much useless expenditure, and sometimes ends in failure. I think, therefore, that this enterprise is worthy of notice as an example of the way in which such mining operations should be undertaken.

When everything was ready, the work was begun with the best appliances, and no necessary expense has been spared to make the operation a success, although there has been no useless outlay. Mr. PLEASANTS at first proposed to sink a single shaft to be used both as an upcast and downcast, until another air-way could be driven out from the top of one of the anticlinal axes. In the meantime, however, the Pennsylvania mining law was enacted, and, as it requires that any mine, in which more than twenty men are employed at one time, shall have at least two openings, separated by not less than 150 feet of solid strata, it was decided to sink two shafts simultaneously. The depth to which the shafts will be sunk is estimated at about 1500 feet, the distance depending upon the diminution of dip in the strata. If the dip of the mammoth vein in the synclinal C, is slight, the depth of the shaft will be less than if its dip is steep. The dip diminishes as the distance from the surface increases. It was finally decided to sink the two shafts (known as the East and West Shafts) about 700 feet apart along the strike of the central basin above the point marked C on the section Fig. 1. Fig. 2 is a topographical map showing the relative position of the two shafts A and B, the railroad which is to transport the coal, the configuration of the ground, the slope CD and gangway FD, which is driven in one of the upper veins with a slight rise so that the water will flow from B to D. At the surface the strata is very much inclined, dipping about 70° to the north, but it is probable, as shown in Fig. 1, that the shafts will cross to the other side of the basin, and that the inclination of the strata will decrease. The East Shaft (A, Fig. 2) is intended solely for raising coal, it is 16 feet long and 13 feet 10 inches wide, outside of the timbers, and will be divided into two compartments. Fig. 5 is a section of this shaft showing the timbering below the masonry. Fig. 7 is a section of the shaft showing timbering and stone work near the surface. The compartment, shown in the corner of the shaft in Fig. 7, is used temporarily for ventilation.

The West Shaft (B. Fig. 2, Fig. 4 and Fig. 6,) is 25 feet 8 inches long and 13 feet 10 inches wide, outside of the timbers, and will be divided into three compartments, two of which will be used for raising coal and for hoisting men, timber, slate, rock, etc., and the other will be for some years the upcast of the collieries. A suction fan will be used for ventilating the mines. No provision will, at present, be made for putting in pumps for the following reasons: In this part of the Anthracite Coal Field, very little water is met with, when a depth of 500 feet from the surface has been reached, unless the superincumbent strata have been fissured and broken by mining out the veins below that level, so that for a long time the little water that will be met with in the mines can be raised by the winding engines at night, tanks being substituted for the cages. When the underground workings have reached the tops of the anticlinals, one or more air shafts will be sunk to them, and after they are finished, the third compartment being no longer required for ventilation can be used for the pumps, should they become necessary. There will be ample room in it for pumping machinery of the largest kind.

Fig. 3 is a cross section of the East Shaft and of the Big Tracy vein, which (as is also shown on Fig. 1) will be cut by both shafts about 400 feet below the surface. A slope has been sunk on this vein (see C D Fig. 2, and also Fig. 1 and Fig. 3,) nearly to the point where it will be cut by the shafts. From the foot of the slope a gangway (D F Fig. 2,) has been opened at that level in the vein, and from it the cross cuts E A and F B. (Fig. 2) have been driven to the points through which the shafts, when sunk, will pass. A hole has been bored in the bottom of the East Shaft to the cross cut E A, Fig. 2, by the method to be explained further on, through which the water, that accumulates in the shaft, finds its way to the sump at the bottom of the slope, from which it is raised to the surface by a Cameron pump. A hole is now being bored for the same purpose in the West Shaft to the cross cut F B, Fig. 2.

Fig. 3 also shows the masonry and brick work in the East Shaft, and Fig. 3 *a* those, in the West Shaft. In the East Shaft (see also Fig. 7), there is a wall of cut stone 4,5 feet thick and 16,3 feet high built upon the solid rock, and above this a brick wall 4.5 feet thick and 16,8 high. The space (about two feet wide) between the masonry and brick-work and the alluvium is filled with puddled clay, by which the infiltration of the surface water is prevented and the walls of the shaft protected from its destructive action.

As the strata, upon which these walls are built, are highly inclined (from 70° to 80°), it was necessary to put in below the masonry four sets of iron girders, such as are shown in Fig. 13 and Fig. 14, in order to prevent wedges of rock from being pressed out by the superincumbent weight. The West Shaft, see Fig. 6, is walled up in the same manner, but the brick work is 43 feet high and 4 feet thick, and the masonry is 8 feet high and 4 feet thick; under the masonry there are seven sets of iron girders similar to those represented in Fig. 13 and Fig. 14.

When the two shafts pass the level of the cross cuts from the gangway F D Fig. 2, water-tight troughs cemented around the sides of the shaft will be put in, by which all the water entering the shaft above that level will be caught and conducted into the slope and from there raised to the surface. It is not thought probable that much water will be met with in sinking below this level, but that all which will accumulate can be raised in the buckets with the rock, etc.

The two shafts are so located that they will cut the mammoth vein at about the same level, not exactly in the center of the basin, as there is always an advantage in having a certain amount of coal below the bottom of the shafts for pumps etc.

We now come to the consideration of the most interesting and novel part of the work, i. e., the method employed for blasting out the rock. It was determined to dispense with the use of hand labor in drilling the holes for blasting, and the diamond drill was chosen as the best instrument for the purpose.

This had already been done in other places, but Mr. PLEASANTS decided, after careful consideration of the subject, to try a new plan of working with the diamond drill, which had been suggested to him. The plan was to sink the shaft, as usual, down to the solid rock and then, by means of a number of diamond drills, each driven by its own machine, to bore a series of holes about 300 feet deep, which should be so arranged as to dispense with further drilling for blasting, until that depth had been reached. Fig. 4 and Fig. 5 are plans of the two shafts, showing the number and positions of the holes in each. In the East Shaft 25 holes are used and in the West Shaft 35. In each shaft one of the holes was bored down as quickly as possible until it reached the cross cut from the gangway and slope, and in this way not only the water which drained into the shaft from the surrounding strata, but also that which had been used in the drilling, found its way to the slope, and was then pumped to the surface.

TO BE CONTINUED.

Nickel.

THE GAP MINE IN PENNSYLVANIA.

MOST of the nickel of the world, until within a few years, came from Germany, but the discovery of these mines has entirely driven the foreign article from our market, and considerable quantities are now exported to Europe. This deposit is the only one now worked in this country, and is believed to be the largest yet discovered in the world. The mine is in Lancaster County, Pennsylvania, about three miles south of the Gap Station, on the Pennsylvania railroad. It is on the high land separating Chester and Pequea Valleys, a region rich in minerals; for beside the copper found in connection with the nickel, large deposits of iron and lime-tone are found a short distance south. The existence of copper here was known many years ago, and copper was taken out 70 years ago, but the mining was never prosecuted with much vigor, nor with much profit.

About the year 1856 the material mixed with the copper was discovered to be nickel, and at the depth to which the mine now reaches, it predominates. The depth of the mine is 240 feet and its length several hundred. The ore is very hard, and the mining is carried on altogether by blasting. There are a few Cornish miners to take the lead, but the others are generally Americans. A Cornish pumping engine of 75 horse power draws half a barrel of water at every stroke from the mine; another draws the ore to the surface. The ore, in appearance, is iron gray, very heavy, and in some pieces the bright copper ore is very prominent. The amount of ore taken from the mine varies from 400 to 500 tons per month. The mining and manipulation of this amount, of course, requires a number of workmen, and there are 175 hands employed here and at the furnaces. The ore is hauled in wagons about half a mile to the furnaces, situated on very high ground, overlooking the beautiful Pequea Valley. The situation was chosen because the wind would carry away the disagreeable smoke and gas, and also because of the stores of limestone and flint in the neighborhood.

The ore is first thrown between the jaws of a ponderous iron breaker, by which it is reduced to small fragments weighing about half a pound each. Thence carts convey it to the kilns, which are constructed very much as are the old-fashioned lime kilns, except that these have a very tall smoke stack to carry the smoke and gas out of the way and increase the draft. A kiln, holding 80 or 90 tons, is filled with ore and kindled with a little wood. It burns for about six weeks, its own gas supplying the fuel for burning out the impurities. This first step toward purification is followed by a process almost precisely similar to that to which iron ore is subjected. There are three large furnaces, and into these the

ore is now put, mixed with powdered flint and limestone (the former predominating) and coke. About three draws are made in 24 hours, for the work does not stop night or day, two sets of hands being employed. The product of the furnaces is passed through iron rollers and crushed to powder, in order that it may be more easily transported to Camden, N. J., where the final process of separating the nickel and copper, and preparing each for the market, is effected. No waste is allowed.

The ore dust, large quantities of which are made in drilling and blasting, is mixed with flux and clay, baked in square bricks and roasted in the furnace, just as is the rest of the ore. Pure nickel commands a high price, varying, of course, according to the demand, but generally over $2 per pound, and its use is rapidly being extended. Not only does this mine supply all the material for our nickel coins, but it is being extensively used in plating iron and other metals and in various compounds. The whole property is owned by a Philadelphia gentleman, and he has by his energy and capital opened up a new branch of industry for the American artisan, and has taken us along another step toward supplying ourselves with the useful in the arts and manufactures. But not upon the proprietor alone are the benefits of this enterprise falling. The hands employed form a valuable class of citizens. Land in the vicinity of the mines has risen to five times its value 20 years ago.

Thus it is that Pennsylvania, through her valuable mineral deposits, is increasing her wealth by mining and manufacturing interests, even in the midst of her valuable agricultural territory.—*Correspondence N. Y. Times.*

High and Low Furnaces.

WITH all the evidence in favor of high furnaces for smelting iron ores, there are many iron masters who decline to build them. The *Ironmonger*, in describing some new furnaces in Warwickshire, England, says: The furnaces have been designed and built under the immediate supervision of Mr. MILLWARD, who has profited by Messrs. ADDENBROKE'S experiments with tall furnaces; for, though they comprise all the improvements of the Middlesborough plant, yet their height has been confined to the old Staffordshire standard of fifty feet, with fourteen feet bosh, and six feet hearth. It must be some little consolation to the Staffordshire ironmaster of past years to know that, in this matter at least, he knew what was best for himself; and it has to be proved that from seventy to seventy-five feet is not the maximum economical height for furnaces in which the hard coke of Durham reduces the lean stone of the Cleveland Hills. All the arrangements of these new furnaces in Warwickshire possess an air of compactness, and indicate the practical foresight of the designer. Between the furnaces there is a lift worked by a pair of coupled engines, which will send up three laden barrows at a time; the gas of the furnaces will be utilized upon the patent of Messrs. ADDENBROOKE-MILLWARD, and the five boilers and the three coke ovens will all be fired by the gas. Excepting the charges nothing will have to be lifted, for the hearths are raised nearly ten feet above the ground, and the railway trucks run up to the furnaces. The furnaces are encased in iron supported on columns, and the whole of the lining is supported on arches which spring from column to column. The stack is what is known in Staffordshire as a "stogger," for whilst its diameter is 10 ft. at the bottom, it is 11 ft. 6 in. at the top. It is 180 ft. from the surface of the ground.

Striking Extraordinary.

THE *Buffalo Commercial* gives some details concerning the Port Henry strike, which put the affair in a light that would have been considered extraordinary a few years ago, but which is now less remarkable from the fact that English workmen have shown us how absurd they can make their claims. It will be remembered that about 1700 Union men in the employ of this company demanded, as a condition upon which they would remain at their work, the discharge of an overseer who had dismissed a Union man because the latter neglected his work and used insolent language to the former when spoken to about his neglect.

At the request of the leaders the company had just built the Union a capacious hall in which to hold meetings, and had also made a material advance in the rate of wages in obedience to the demands of the Union. But when this last unreasonable demand was made, the company decided to settle who was to manage the business, the proprietors of the mill or the workmen. The Union men were therefore all dismissed, and informed that they could not again enter the company's service until they renounced all connection with the organization.

The strike has ended in the complete discomfiture of the Union men, who resume work at the same wages they had before. Some valuable concessions that had been made them were revoked, and two weeks' pay was deducted. This strike has resulted in a loss of from $40,000 to $50,000 to the strikers, and leaves them worse off in every respect than they were before it commenced.

Native Bismuth in Colorado.

WE had the pleasure of securing some small nuggets of native Bismuth from Summit County during the month. They were found with the gold in the flume of the Badger Mining & Fluming Co., in French Gulch. Mr. TABER, Superintendent of the Company, has, for some time past, detected these nuggets in the riffles, but not having the necessary apparatus for determining the metal, was unacquainted with their character and composition. The Bismuth was entirely free from silver, antimony, and arsenic, dissolved completely in nitric acid, and in the state when found showed the bright crystalline fracture peculiar to the metal in a pure condition.—*Colorado Mining Review.*

On the Economical Preparation of Iron for the Danks' Puddling Furnace.*

By CHARLES WOOD, Engineer, Tees Iron Works, Middlesbrough.

It will be fresh in the minds of the members of this Institute that at the meeting at Dudley, in August, 1871, Mr. DANKS brought before your notice his revolving puddling furnace. The very satisfactory statements made by Mr. DANKS on that occasion resulted in a commission being sent out by this Institute to America, to examine into the whole question, and the very able report of the scientific investigation of those gentlemen is well known and appreciated by all those who are in any way connected with the trade. Some of the few defects pointed out by these gentlemen are: the very large quantity of coal consumed per ton of puddled bar produced, and the destruction to the lining of the furnace when charging with pig iron. This destruction arises from two causes. Firstly, the pigs are generally broken in halves, and are put into the rotary furnace in charges of about half a ton each. The melting of this pig iron is the most serious item to contend against; the pigs lie in the bottom of the furnace impenetrable to the heat; the rotary furnace cannot be set in motion except with the greatest caution, for fear of the pigs rolling over and knocking the lining to pieces; even with the greatest care half an hour is often spent in preparing the lining for the next charge. Secondly, there is also considerable damage done to the lining of the furnace and the iron produced, by the presence of a large quantity of silica, which is introduced with the pig iron in the shape of sand.

To meet these difficulties the American Commissioners proposed to reduce the iron to a molten state before introducing it into the furnace, and, no doubt, at first sight, this appears to be the right thing, but somehow or other, from causes I am unable to explain, not having had sufficient practical experience, the yield of the iron and the quality is not so good as when the cold iron is charged. Perhaps it may in some way be accounted for by the fact that the molten iron does not take up so much from the fettling, and again, the molten iron not being so long in contact with the fettling, may not part with so much of its impurities. Then again, there is the serious cost of melting by the cupola, which cannot be done much under the following sums:

Waste of iron in melting, 4 per cent.	4s.
Carrying metal	3d.
Wear and tear of cupola and tools	6d.
Coals and engine power	1s. 7d.
Charging and working cupola	1s. 5d.
Coke for melting, including charging, 3½ cwts., at 38s.	6s. 7d.
Limestone	1d.

Making a total of 14s 5d. per ton before it goes into the rotary furnace. These figures are obtained from a cupola running 40 tons per day, and are a fair avera cost.

It will, therefore, be seen that although the cupola process is undoubtedly a saving over the system of melting the pigs in the rotary furnace, yet that it is an imperfect and very costly process, and it is with an idea that I have succeeded in overcoming all these difficulties that I have the pleasure of reading this short paper before you. I had the honor at the last meeting of reading before you a paper on the utilization of blast furnace slag, and I then showed you my models and system of granulating the slag as it flowed from the furnace, as well as samples showing the perfect manner in which the granulating and cooling is effected. These samples, for the information of the gentlemen here present, I have pleasure in showing again on a small scale. The perfect granulating action of the machine induced me to try its effect upon iron, and I ran the iron straight out of the furnace into the machine, and produced the sample of iron on the table before you; the application of this to the Danks furnace suggested itself, and, at Mr. DANKS' request, I tried a larger quantity; this has been since tried in one of the rotary furnaces at work at the Tees Side Iron Works, Middlesbrough, with the greatest success—the charges are brought out in about 35 minutes, the quality of the iron is very superior, and the yield quite as good as if pigs had been put in, whilst the lining of the furnace is little the worse.

It will be seen that by charging the furnace with the granulated iron the machine can be set revolving at once, thus exposing the whole surface of the iron to the heat, which is at once taken up, and the iron is smelted in an incredibly short time. The iron runs from the surface into a big ladle or dam, whence it is tapped out—in the same way as from a cupola—in a small stream into the machine, so as to keep it under control, and avoid all possibility of an explosion. A sample of iron is taken from each tapping to show the quality of the iron in its granulated state; the iron is delivered by the same machine at one operation into iron trucks, whence it can be delivered direct to the puddling furnace. The action of the machine will be better understood by consulting the drawing, (See IRON, vol. ii., p. 240). You will observe that it is made in a shape not unlike a rotary puddler, only much larger, being from 12 feet to 14 feet in diameter, and having sides, so as to enable it to contain between 3 feet and 4 feet of water. This cylinder is kept in motion by a small steam engine, and will make from five to six revolutions per minute, according to the size the iron is required to be granulated. You will notice that there are a series of buckets or agitators, which, being fixed to the cylinder, rotate with it. These buckets or agitators passing through the water, keep the water in a violent state of motion—the water having a tendency always to rush to the bottom—but meeting with the buckets it rolls over in a violent manner. Into this water the small stream of molten iron is run, and is scattered, as it were, in the body of the water, where it is held in suspense sufficiently long to prevent its touching the plates at the

* Iron and Steel Institute—Liege Meeting.

bottom while in a liquid state, and thus avoids all possibility of explosion. On this point alone rests the failure of all former attempts to granulate iron in water. The buckets, or agitators, also elevate the granulated iron to the top of the machine, where it drops into a spout, and thence into railway trucks or wagons, holding about a charge for the puddling furnace.

In conclusion, I would wish it to be understood that I do not claim the invention of granulating iron as new, as, to my own knowledge, it has been more or less tried during the past twenty years; but what I do claim is the very simple and inexpensive mode of producing granulated iron, and one which will at once offer itself as a practical solution of the difficulties before named, and which is calculated to effect a saving of at least 10s. per ton on the finished iron.

THE DISCUSSION.

MR. DANKS.—The paper that you have just heard by Mr. WOOD brings under your notice a very important fact connected with the puddling of iron. This is a subject that has long occupied the minds of practical men. I have had more or less to do with granulating iron for the last twenty years, but not exactly in the way Mr. WOOD has indicated. I have ways of my own, and they have not been always successful, but there are some advantages claimed for this mode of granulating iron which it would be wrong of me to let pass without some notice. I am informed that here and in France it costs 8f. per ton to melt iron in a cupola, and it costs from 5s. to 6s. per ton in England. All that this machine will save in the puddling will be what it saves here. The question then arises, what does it cost to melt iron in a Danks furnace? If it costs less money than it does in a cupola the latter ought not to be used unless there are other advantages to cover it. Now, there are advantages in this granulated iron that you will all see at once. It is not only put into a size to melt easily and with comparatively little fuel, but you get it clean and free from sand, and the sand that sticks to the outside of pig iron is a much more serious thing than many of us are aware of. That sand enters into the furnace and converts the oxide into a silicate, in which condition it is of no further value as a lining for the furnace, because it melts at a low temperature. If you get clean iron, therefore, free from sand, it saves all that. If there is no sand or other impurity to combine with the oxide of iron, the oxide of iron remains. But what does it cost to melt this iron in a Danks furnace? It takes about one-third of the time required for puddling—no time can be really fixed. Iron with a large percentage of carbon melts sooner. Some require thirty-five to forty minutes, while other iron will melt readily inside of twenty minutes; so that we may assume the average time to be about half an hour. This is rather inside the time required for melting in a Danks furnace. Now, it would be difficult for anyone to burn over three tons of coal per day in a Danks furnace, let them try their best. Assume that the furnace will melt six heats per day—although we have frequently melted eight of cold pig metal—that would give us a yield of three tons. I name this below what the furnace is really capable of, for the purpose of showing what it actually costs to melt. If it takes one-third of the fuel used for puddling to melt a ton of cold pig, it plainly costs 5s. per ton for fuel for melting in a Danks furnace. We may add to that the cost of labor, at, say 8s. per ton, which would give a cost of 24s. per day for working each furnace. This is putting it at a high figure. If we use one-third of the labor that you use, we have an expenditure of 7s. 6s. per ton; but the question arises, is it fair to charge the melting with the labor, seeing that while nothing is going on labor is at rest? But we will assume that labor properly belongs to it. Then there is the expenditure of 7s. 6d. per ton to melt it. We can make six heats per day from ordinary pig. If we can make one heat more from granulated iron, of course the granulated iron should be credited with it, because we save one-seventh, or 7s. 6d. If we can make two heats per day more it will just double that; but the saving in this granulated iron, taking it purely on the coal and labor question, will not effect a saving of more than 2s. per ton. There are, however, other savings to be considered; there is the saving of lining, and I think myself that we may calculate upon an improved quality with the same grade of iron, although this will not apply to all grades, because if you have iron that melts quite liquid in the bottom of the furnace the saving is not so great. The loss will depend upon the quality of the sand or other impurities in the iron. If we get a greater heat, and if the lining is not used up with this sand and converted into a silicate, we may conclude that the carbon will take up a considerable proportion of the oxygen of the ore. Take cast iron borings as an example. We have made as high as fifteen heats per day in America, and the iron squeezed well and rolled well, and the bars were as sound and smooth as any bars you ever saw—indeed, they looked more like reheated iron than the ordinary puddled bar. Unless, however, I could bring it to a liquid state in the furnace, I never could produce as good results as when I did bring it to a liquid state. Now, in America, we have what we call stone castings. There are thousands of tons made every year; we have used at our works alone 2500 tons in a single year. They vary from one-eighth to three-eighths of an inch, and the yield from such plates was simply enormous. When we puddled eight heats per shift of cold pig and changed on to these old stone plates, the uniform product was ten heats per day. That was as regular as anything could be, and the increase of the yield over pig iron was generally from 5 per cent. to 6 per cent., and the beginning sometimes was as high as 21 per cent. over the charge of metal in the furnace. I made some figures based on former experience, to show what I think will be the saving from iron properly granulated. There is a considerable amount of irregularity in granulated iron; but as regards the present mode of puddling pig iron in the revolving furnace, it is simply barbarous. The best way to puddle iron is to take it direct from the furnace in a molten state. This cannot always be done, but where it can it should always be carried out. Where it cannot be done, I should advise the use of granulated iron. To take Mr. WOOD's water machine, and granulate some kinds of iron that melt at a low temperature, would not give a gain so great as the use of stone plates one-eighth of an inch thick. The iron should be so divided or granulated as to secure uniform thickness. If they mixed large pieces with small, the small pieces would melt before the large ones. I have heard of a machine that does reduce iron in that way. There is absolute control over the thickness of the plates. If a blast furnace could always be kept on the same grade of pig metal Mr. WOOD's machine would do very well; but the running of some kinds of pig iron into water would make it difficult to melt. So far as the Cleveland iron is concerned, I believe that Mr. WOOD's machine is very good, but I still believe that there are other ways of granulating iron that would make it much more uniform than is possible in that machine.

Captain BODMER, being called on by the President to state his experience, said that he had one pair of rolls at work, about 3ft. 6in. diameter, and the speed varied according to the quantity to be passed through. If the two rolls were worked at equal speed they produced sheets, and at a differential speed they produced a kind of scales. The greater the difference in the speed the smaller was the scale. As an experiment, they had made perhaps one and a half tons at a time, and there was no difficulty in doing it. The iron was run in from the blast furnace, and if the rolls were sufficient in diameter and speed to take the quantity run in there was no trouble about it. The iron came out almost cold. They had a simple moving sheet of iron, called a shaker, underneath the rolls, and the iron was delivered out quite cold. They got a charge from a common furnace in twenty-five minutes, but in these charges they used oxide mixed up with cast iron, and the iron was not melted as it ought to have been.

Mr. WOOD wished to explain that so far as the irregular granulation of the iron was concerned, it altogether depended upon the velocity at which the machine was driven, and the depth of the water. He had no hesitation in saying that with his machine he could granulate iron as regularly as possible. So far as regarded running the cast iron into plates in the way mentioned by Mr. DANKS, some of them would probably know the cost involved for chills used in that way. If they ran molten iron into chills, it would necessarily cost a good deal for wear and tear; the same remark applied to a certain extent to any mechanical motion for rolling out molten metal.

Mr. EDWARD WILLIAMS thought that the figures given might easily be put right. He was afraid that forge iron would not stand for ever at 100s. per ton. Mr. WOOD had assumed that it would be so. If it should come down to the ruinously low figure of 62s, per ton, that which Mr. WOOD put at 14s. would come down to 2s. 6d. Coke was not always to be 38s. per ton. If it fell to 20s., and they used 2 cwt. instead of 3½, that which Mr. WOOD put at 6s. 7d. would come down to 2s. There were other items higher than they should be, in Mr. WOOD's calculation; and assuming that coal, coke and iron came down to prices considerably above the average of the few last years, the amount which Mr. WOOD put at 14s. 5d. he put at 8s. 2d. That, he thought, would correspond with Mr. DANKS' opinions. As regards the matter of running iron into chills, he had only to say that they did it at the works he managed—BOLCKOW, VAUGHAN & CO.—and the cost of the chills was less than the cost of the sand, for sand-pits, where they were working on that system.

Mr. CROW, engineer at the Tees-side Ironworks, showed some specimens of granulated iron which he said had been puddled by him from molten iron direct from the cupola in fifty minutes. The iron showed an excellent fibre.

The President: Did you find any effect on the lining of the furnace?

Mr. CROW: Yes; this iron chilled and stuck to the furnace.

Mr. WHITWELL: It would be well if Mr. CROW could tell us the difference in quality.

Mr. CROW: I cannot speak with anything like certainty, as these were merely experiments.

Casualties.

FOUR men were seriously injured recently by the bursting of a crucible at MESSRS. SPENCELAGH & ARCHER's foundry, Rochester, England.

EXPLOSION OF A FURNACE AT TALK-O'-TH'-HILL, ENGLAND.—At the ironworks of the North Staffordshire Coal and Iron Company at Talke, an accident has occurred which resulted in serious injury to three workmen. There are blast furnaces connected with the colliery, and at No. 2 furnace, the iron got above what the furnacemen call the "tuyeres," this being the result of a "hard top," as it is termed. The effect was that the furnace exploded. Great damage was done, and three of the men engaged in attending to the furnaces were injured more or less severely.

AT the North Chicago rolling mills about a dozen workmen were engaged last evening in removing an imperfect blast from one of the furnaces, when suddenly a large mass of clinker was detached, making an opening in the furnace, and an immense volume of gas rushed out, and coming in contact with the outer air, exploded, filling the place with a sheet of flame, which completely enveloped eight workmen, five of them, James Mack, Michael Holley, John Brith, James Schaffner and Patrick Mauney, were so horribly burned that not one is expected to recover. Three other workmen, Owen Corbett, Thomas Conner and Nicholas Schevelin, were seriously, but, it is thought, not fatally injured.

THE COAL TRADE.

NEW YORK, Sept. 18, 1873.

Business continues good, both in anthracite and bituminous coal, prices being unchanged. There seems to be very little or no apprehension of a disastrous spread of the present panic among stock speculators to more steady business circles. We have even heard one gentleman say that in his opinion, good business paper will be sought for by lenders, who are thrown out of the speculative market by the present excitement.

This is the day fixed for the opening of the Chesapeake Canal, and if the managers are as prompt as they promised to be, boats will begin to arrive next week, but as we write, no advices of departure have been received. The stock in the city is of course very low, and prices are still quoted at $7.50 to $8.

The auction sale will take place on Wednesday next, the 24th day of the month. Ninety thousand tons will be offered, against 75,000 tons last year.

Anthracite Coal Trade for 1872 and 1873.

The following table exhibits the quantity of Anthracite Coal passing over the following routes of transportation for the week ending, 1873, Sept. 13, compared with the week ending Sept. 14, 1872.

COMPANIES.	1872. WEEK.	1872. TOTAL.	1873. WEEK.	1873. TOTAL.
Phila & Reading R.R†	97,639	3,317,818	111,290	3,397,844
Schuylkill Canal	21,412	579,102	21 398	516 233
Lehigh Valley R. R.	69.69	2,578,731	75.008	2.503,317
Lehigh & Sus. R. R.	36,755	1,183,554	47,915	1,394,070
" " Canal	21,125	525,022	29,149	491,585
Scranton North	21,3 0	542 813	27,334	657,432
" South	57,688	1.5 3,389	38,716	1,468 524
Penn. Coal Co., rail	26,162	834,115	29,118	869,379
" " " canal		4 076	118	5.445
Del. & Hud C.Co. Canal	43,470	990 566	46,474	1,005,675
" " East	10,725	393 928	11.706	292,319
" " West	8.912	274,986	16,120	377,887
" " South	10,-82	169 3 8	3 534	141,297
Shamokin	10,668	3 5,315	14,256	440,100
Trevorton	....	....	....	....
Lykens Valley Coal Co.	....	....	....	....
Wyoming North	....	....	....	....
Wyoming South	....	....	....	....
P. N. Y. C. & R. R. Co.	10,303	452,111	13,749	543,584
Williamstown Coll'y	....	....	....	....
Big Lick Col	....	....	....	....
Total	410,048	13,617,774	490,785	14,437,895
1872			410,048	13.617,774
Increase			80,743	820,171
Decrease				

These figures are for the week and fiscal period commencing Nov. 30

† Iron coal transported for Company's use and Bituminous coal.

Bituminous Coal Trade, 1872 and 1873.

The following table exhibits the quantity of Bituminous Coal passing over the following routes of Transportation for the week ending Sept. 13, 1873, compared with week ending Sept. 14, 1872.

COMPANIES.	1872. Week.	1872. Year.	1873. Week.	1873. Year.
C. & O. Canal	15,308	452,785	22,716	420,208
B. & O. R. R.	22,394	875,238	30,863	1,027,242
Penn. S. Line	....	.....	4.230	64,849
H. & B. T. R. R.	6.064	206,346	12,295	306.584
*Harrisburg & D	9,726	342 698	8,439	240,829
*L. V. R. R.	16	21,313	478	22,678
P. & N.Y.C. & R. Co.	6,057	263,764	5 083	226 535
Cumberl'd Branch Canal	5,412	153,255	5,115	86,213
" Railroad	268	12,988	1,390	65,839
Total	65,545	2,334,437	90 609	2,460,977
Decrease	....		65,545	2,334,437
Increase	....		25,064	126,540

Report of Coal Transported over the Lehigh Canal

For the week ending Sept. 12, 1873.

REGIONS SHIPPED FROM	TIDE. tons. ct.	LOCAL tons. ct.	TL WEEK tons cwt.	TL. DATE tons, cwt.
Mauch Chunk Region	3,218 07	5,207 07	8,455 14	155,750 02
Mauch Chunk Region Hazardville	1,877 12	194 11	2,072 01	17,735'14
Beaver Meadow Region	985 11	4,773 18	5,759 09	68,941 07
Mahanoy Region		381 17	381 17	14 613 18
Hazleton Region	1,150 09	4,461 17	5,611 06	127,987 07
Upper Lehigh Region	90 06	967 17	1,077 05	19,461 08
Wyoming Region	3,769 19	1,538 10	5,308 09	66,-33 06
Wyoming Region, Hazardville	482 15		482 15	3,318 14
Total	11,614 08	17,514 17	29,148 18	454,584 19
Previously reported	168818 19	296.7 02	465,436 01	
Total to date	180433 00	314121 19	494,584 19	
Corresponding week last year	200313 02	326708 13	527,021 15	
Increase				
Decrease	19,880 02	12,556 14	32,436 16	

DISTRIBUTION.	WEEK 1873.	WEEK 1372.	YEAR. 1873.	YEAR. 1872.
Consumed on line of Lehigh Canal	2,842 18	2,647 04	51,051 14	51,279 06
Passed into Morris Canal to Tidal Points	137 13	131 19	2,063 09	4,167 05
Passed into Morris Canal to Local Points	1,279 01	733 17	27,182 19	16,793 05
Passed into Del. & Rar. Canal to Tidal Points	11,476 08	7,516 10	178,469 11	196,145 16
Passed into Del & Rar. Canal to Local Points	576 13	393 09	8,784 00	10,587 09
Consumed on line Delaware Div. Canal	1,935 01	1,584 04	30,272 01	31,143 01
Passed through to Bristol	10 601 04	8,087 12	202,761 05	215,105 12
	29,148 18	21,124 15	494,584 19	527,021 15

Philadelphia & Reading Railroad and Branches.

COAL TONNAGE

For the Week ending Saturday, Sept. 13, 1873.

BY RAILROAD.—ANTHRACITE.

PASSING OVER MAIN LINE AND LEB. VAL. BRANCH.

	Tons. Cwt.
From St. Clair	39,734 06
" Port Carbon	4,755 18
" Pottsville	3,464 05
" Schuylkill Haven	36,648 07
" Pine Grove	7,190 10
" Tamaqua	15,139 10
" Harrisburg	
" Dauphin	4,355 16
Total	111,289 14

FOR SHIPMENT BY CANAL.

Passing Frackville Scales	7,997 14
" Mill Creek "	1,414 08
" Schuylkill Valley Scales	547 18
" Mt. Carbon "	1,579 00
" Cressona "	7,170 03
" Pine Grove "	....
" Tamaqua "	3,187 16
Total	21,817 16

SHIPPED WESTWARD VIA CATAWISSA AND WILLIAMSPORT BRANCH AND NORTHERN CENTRAL RAILROAD.

Via Catawissa & Williamsport Br.	614 10
" N. C. R. R. passing Locust Gap	1,603 01
" " " Shamokin	4,711 15
" " " Herndon	....
Total	6,963 06

SHIPPED WEST OR SOUTH FROM PINE GROVE.

Via Schuylkill & Susquehanna R. R.	2,032 19
" Lebanon & Pine Grove Branch	314 16
Total	2,947 15

CONSUMED ON LATERALS.

From Frackville Scales	605 09
" Mill Creek "	89 09
" Schuylkill Valley Scales	770 02
" Mt. Carbon "	1,017 10
" Cressona "	646 16
" Pine Grove "	59 16
" Tamaqua "	473 11
Total	3,673 13

LEHIGH AND WYOMING COAL.

Received via Silverbrook Junction, Sent East	9,562 06
Cat. & Wpt. Br. Sent West	....
" " Rupert, Cat. & Wpt. Br.	....
" " Allentown E. Penn'a Br.	402 07
" " Alburtis, " "	25 10
" " Oreland, G. & N. Br.	191 18
" " Willow Street R. R.	640 00
Total	10,822 01

BITUMINOUS.

From Harrisburg	8,428 14
" Connecting R. R., G. & N. Br.	
" Junction R. R.	10 00
Total	8,433 14

COAL FOR COMPANY'S USE.

Anthracite	6 449 05
Bituminous	1:1 18
Total	6.621 03

RECAPITULATION.

	Total for Week.	Corresp'g week last year.	Increase and Decrease.
Passing over Main Line and Leb. Val. Branch	111.289 14	97 680 07	i 13,609 07
For Shipment by Canal	21,817 16	23,152 15	i 1,665 01
Shipped Westward via Northern Central R. R.	6,969 06	6,054 09	i 914 17
Shipped West or South from Pine Grove	2,947 15	1,622 00	i 1,325 15
Consumed on Laterals	3,673 13	4,191 00	d 517 07
Lehigh and Wyoming Coal	10,822 01	1,725 09	i 9,093 12
Total Anthracite paying freig't	157,520 05	131,424 09	i 26,096 05
Bituminous	8,438 14	9,726 09	i 1,287 15
Total of all kinds paying freig't	165,958 19	141,150 09	i 24,808 10
Coal for Company's use	6,621 03	5,347 12	i 1,273 11
Total Tonnage for Week	172.5 0 02	146,498 01	i 26,082 01
Previously this year	469364) 02	443 879 15	i 254 760 07
Total to date	4966220 04	4585377 16	i 280,842 08

SHIPPED BY CANAL.

From Schuylkill Haven	18.264 04	20,872 00	d 2,547 16
" Port Clinton	3,044 00	1,047 00	i 1,997 00
Total to date	21,308 04	21,859 00	d 553 16
Previously this year	494,924 15	562,156 15	d 67,732 00
Total to date	516,232 19	584,015 15	d 67,782 16

Statement of Coal Transported over Cumberland and Pennsylvania Railroad

During the week ending Saturday Sept. 13, and during the year 1873, compared with the corresponding period of 1872.

WEEK.

	C. & O. C'l Tons. Cwt	B. & O. R. R. Tons. Cwt.	Pa. S. Line Tons. Cwt	Total. Tons. Cwt
1873	22,716 19	30,863 17	4,229 16	57,809 12
1872	15,307 12	22,394 03	....	37,701 15
Increase	7,409 07	8,468 14	4,229 16	20,107 17
Decrease	..	.....	....	

YEAR.

1873	423,207 19	1027241 15	64,848 14	1,512,298 08
1872	452,785 01	875283 06	....	1,328,073 07
Increase	....	151,923 09	64,848 14	184,225 01
Decrease	32,577 02	....	....	....

Cumberland Branch R. R.

WEEK.

	To C. & O. Canal. Tons. Cwt.	To P.&O.R.R. Co Tons. Cwt.	Total. Tons. Cwt.
1873	5,115 10	1,389 18	6,505 08
1872	5,411 14	268 04	5,679 18
Increase		1,121 14	825 10
Decrease	296 04	.....	.....

YEAR.

1873	86,212 11	65 8 9 03	15 ,011 14
1872	153,254 11	12,887 19	166,242 10
Increase	.....	52,851 04	
Decrease	67,042 00		14,190 16

Penn. and N. Y. R. R.—Coxton, Pa.

Coal tonnage for week ending Sept. 13, 1873.

	Week. Tons. Cwt.	Total. Tons. Cwt.
Anthracite received:		
From Lehigh Valley R. R.	13,078 18	365,191 10
" Lack. & B. R. R.	1,947 07	29,195 17
" Pleasant Valley R. R.	2,729 15	121,694 11
" Sul. & Erie R. R.	992 19	26,899 05
Total	18,748 19	543,584
Same time last year	10,303 09	454,110
Increase	8,446 10	91,473
Decrease		
Distributed:		
To Lehigh Valley R. R.	187 16	28.755 17
To Lack. & B. R. R.	39 00	1.29. 16
To S. Central R. R.	3,971 16	118,809 00
To Ithaca & A. R. R.	4,863 09	109,756 14
To Erie R. W. Pockets for shipm't.	7,328 16	199,7o3 17
To Erie Railway, Watkins direct.	873 03	8,922 09
To individuals on line of road	440 04	21,571 19
To points at & above Coxton for use of Co.	472 09	20,583 02
To points between Waverley and Elmira	572 06	39,1 3 00
Total	18,748 19	543,584 03
Bituminous received from BARCLAY R. R.		
Shipped north from Towanda	4,968 01	224,602 04
Shipped south from Towanda	6 09	1,698 04
Northern Central R. R.	108 05	234 09
Total	5,082 15	226,534 17
Same time last year	6,056 15	269,763 11
Increase		
Decrease	974 00	43,228 14
Distributed:		
To Erie Railway	4,862 19	204,122 04
To So. Central R. R	105 02	20,039 17
To Ithaca Valley R. R.	....	376 06
Lehigh Valley, R. R.	....	884 07
To individuals on line of Railroad.	114 14	993 19
To points on line of road for use of Company	....	118 04
Total	5,082 15	226,534 17
Grand totals transported		
Anthracite	18,748 19	543,584 03
Bituminous	5,082 15	226,534 17
Total	23 831 14	770,119 00
Same time last year	16,360 04	721,874 07
Increase	7,471 10	48,244 13
Decrease	.....	

Report of Coal Transported over Lehigh Valley Railroad

Report of coal tonnage for the week ending Sept. 13, 1873, with Totals to date, compared with same time last year.

WHERE SHIPPED FROM.	WEEK. Tons. Cwt.	TOTAL. Tons. Cwt.
Total Wyoming	27,837 05	666,904 19
" Hazleton	52,896 01	1,671,325 17
" Upper Lehigh	76 11	2,306 02
" Beaver Meadow	15,522 09	507,274 00
" Mahanoy	16 280 13	384,002 03
" Mauch Chunk	116 13	3,115 13
Total	112,481 12	3,237,925 14
Same time last year	79,499 11	3,015,823 11
Increase	32,982 01	222,092 03
Decrease	.....	.....
Forwarded East from Mauch Chunk by rail	75,007 19	2,503,316 15
Same time last year	60,758 17	2,378,730 01
Increase	14,749 02	124,586 14
Decrease		

DISTRIBUTED AS FOLLOWS.

Local East of Mauch Chunk	2,193 14	59 963 14
Forwarded East for use L. V. R.	1,016 04	40.881 02
Delivered to Furnaces and Manufacturing Companies	14,636 07	532,700 01
Delivered to Cat. & Fog. R. R	137 05	4,964 17
" " East Penn R. R.	320 15	7,243 18
" " North Pennsylvania Railroad	8,163 06	247,181 03
" " Port Del	7,691 10	181,537 14
" " East Amboy Railroad		
" " Morris and Essex Railroad	4,332 02	216,030 12
" " Bel Del Railroad	26,895 18	803,006 01
" " Central Railroad	9,020 18	431,348 08
Delivered at and above Mauch Chunk for use of L. V. R.R.	1,409 18	52,746 12
To P. & N. Y. R. R.	13,078 18	355,194 10
to Northern Central R. R.	2,386 11	16,474 05
To D. H. & W. R. R.	748 14	26,179 05
To L. & S. R. R. at Packerton for rail	394 02	10,410 11
To Individuals at Mauch Chunk	42 02	1,945 11
To Individuals above Mauch Chunk	420 17	11,194 04
to L. & S. R. R., at Penn Hav., for railroad		1 541 10
Do. for canal	5,611 06	127,804 18
To Lehigh Canal Mauch Chunk	2,810 17	54,144 03
To Catawissa Railroad		50 00
To L. & B. R. R. at Lack. Junc.	10,571 08	69,667 10
Total	112,481 12	3,237,925 14

Pennsylvania Coal Company.

Shipments of Pittston Coal for the week ending Sept. 13, 1873.

	1873. WEEK.	1873. YEAR.	1872. WEEK.	1872. YEAR.
By Railway	29 118 09	859,378 11	26,161 19	833,115 06
" Canal	118 13	5,545 10	.....	4,075 12
	29.237 01	874,924 01	26,161 19	837,190 18
Increase, 1873	37,733 03			

Delaware Lackawanna & Western Rail Road Company.

Coal transported on the Delaware, Lackawanna, & Western Railroad for the week ending Saturday, Sept. 13, 1873.

	WEEK. Tons. Cwt.	YEAR. Tons. Cwt.
Shipped North	27,333 18	657,432 04
Shipped South	38,715 16	1,498,328 00
	66,049 09	
Total		2,155,760 04
For the Corresponding time last Year:		
Shipped North	2 ,308 14	512 642 18
Shipped South	37,685 10	1,509,288 10
Total	58,385 14	2,022,031 08
Increase	7,655 05	133,728 16
Decrease		

Report of Coal Transported over Central R.R. of N. J. (Lehigh and Susq. Div.)

Week ending Sept. 13—Compared with same time last year

REGION SHIPPED FROM.	TIDE. tons ct.	LOCAL. tons ct.	CANAL. tons ct.	TL WEEK tons cwt.	TL. DATE tons.cwt.
Wyoming	26057 02	6907 03	4183 17	37148 02	1239 34 03
Upper Lehigh.		2884 04	860 17	3745 05	138614 03
Beaver Meadow	4866 10	2573 15	36 7 01	11107 06	217407 12
Hazleton.....		357 03	5562 01	5919 04	136189 17
Mauch Chunk.	4034 13	2961 16	7665 02	14361 11	392578 16
Total.....	34958 05	15384 05	21938 18	72781 08	2123844 11
Prev'ly reported	976556 10	671906 19	402199 14	2050655 03	
Total to date .	1011514 15	687291 04	424038 12	2122844 11	
Same time .1872	832885 02	601813 13	339732 12	1774461 07	
Increase.....	178629 13	85477 11	84306 00	348383 04	
Decrease.....					

DISTRIBUTION.	WEEK 1873.	WEEK 1872.	YEAR 1873	YEAR 1872.
Forwarded East by Rail to Tidal points . .	34958 05	21376 05	1011514 15	832885 02
Forwarded East by Rail to Local points . .	10398 04	7403 05	312632 03	269682 02
Forwarded East by Rail use Central Division	1755 00	1568 08	62440 06	54873 04
Forwarded East by Rail use L. & S. . . .	204 00	206 17	8 82 19	6183 10
Delivered at and above Mauch Chunk . .	1193 05	1063 04	54875 09	39210 09
Delivered at Coalport & Hazard for Canal .	21938 18	16354 15	458125 15	381594 10
Delivered to L. V. R. R. at Packerton	444 02	180 15	17713 01	10281 19
Delivered to L. V. R. Rd. at Sugar Notch .	651 02		68152 02	
Delivered to L. & B. R. R.at Plymouth Bridge	138 12	6225 00	129908 01	159820 11
Total . .	72,281 08	543:4 09	2122844 11	1774461 07

Northern Central Railway, Shamokin Division.

Below is the return of Coal sent over the Shamokin Division of the N. C. R. W., for the 7 days ending Sept. 12, 1873.

	Tons.	Cwt.	
East.....	693	17	
West.....	13,562	14	
			14,256 11
Same time last year.....			10,667 17
Increase.....			3,588 14
Decrease.....			
Total amount shipped to date.....			440,100 03
Same time last year			385,314 11
Increase.....			54,785 12
Decrease			

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, Sept. 13, 1873.

	WEEK.	SEASON.
By Delaware and Hudson Canal.....	46,474	1,005,675
By Railroad, East.....	11,706	292,319
" West.....	16,120	377,887
" South	3,544	141,597
Total 1873.....	77,834	1,817,478
Corresponding time in 1872 :		
By Delaware and Hudson Canal.....	43,470	990,566
By Railroad, East.....	10,725	399,928
" West.....	8 912	274,996
" South.....	10,582	269,338
Total.....	73,689	1 934,818
Decrease.....	117 34	

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, Sept. 13, 1873.

	WEEK.	SEASON
North.....	56,770 15	1,880,159 03
South.....	3,533 18	141,596 18
Total 1873.....	60,304 13	2,021,756 01
Corresponding time in 1872 :		
North.....	51,078 10	1,814,931 12
South.....	10,582 10	269,338 05
Total, 1872.....	61,661 00	2,084 269 17
Increase North.....	5,692 05	64,227 11
Decrease North.....		
Increase South.....		
Decrease South.....	7,048 12	127,741 07
Increase		
Decrease.....	1,356 07	62,513 16

Prices of Coal by the Cargo.

[CORRECTED WEEKLY.]

	AT NEW YORK R. A.	AT NEW YORK W. A	AT PHILADELPHIA. R. A.	AT PHILADELPHIA. W. A.
SCHUYLKILL.				
Lump.....	$— —	$ —	— —	4 50
Steamer	— —	—	— —	4 50
Broken,.....	— —	—	4 00	4 60
Egg.....	—	—	4 75	4 00
Stove,.....	—	—	4 95	4 80
Chestnut,.....	—	—	3 85	3 85
Pea.....	— —	— —	— —	— —
LEHIGH.				
Freight to New York 50 cents.				
Lump, (on board).....	— —	— —	— —	— —
Broken.....	— —	— —	— —	— —
Egg.....	— —	— —	— —	— —
Stove.....	— —	— —	— —	— —
Chestnut.....	— —	— —	— —	— —
Pea.....	— —	— —		
SPECIAL COALS.				
Honey Brook, Le'h W.A.	5 80@5 05		— —	— —
Spring Mountain " "	5 80@5 10		— —	— —
Sugar Loaf.... " "	4 00@5 90		— —	— —
Room Run..... " "	5 00@5 75		— —	— —
Hill & Harris.. " "	—		— —	— —
Shamokin..... " "	4 10@4 70		— —	— —
Lykens Valley. " "	4 70@6 05		— —	— —
Broad T ..... " "	—		— —	— —

Company Coals.

Sept. 1873.

	L.	Str.	Gra.	Eg.	Sto.	Chest
*Scranton at E. Port.....	— —	— —	— —	— —	— —	— —
Pittston at Newburgh.....	4 90	4 10	5 00	5 10	5 40	4 90
*Lackawana at Rondout.....	5 15	5 25	5 35	5 40	5 70	5 10
Wilk'b're at Pt. John'n.....	4 9	5 05	5 15	5 30	5 50	4 95
Old Co. Lehigh at Pt. John'n	5 90	5 75	5 75	5 85	5 10	—
New York Coal Exchange.....	5 90	5 75	5 75	5 85	5 10	—

For freights to different points see "Freights."
*To contractors only.

Prices at Baltimore—Sept. 1873.

Wholesale Prices to Trade.

Wilkesbarre, by cargo or car load.....	$5 65@6 00
Pittston and Plymouth, do.....	5 40@5 75
Shamokin Red or White Ash, do.....	5 60@5 00
*Lykens Valley Red Ash, do.....	@6 30
By retail, all kinds per ton of 2,240 lbs.....	7 25@8 25
*George's Creek and Cumberland f. o. b. at Locust Point for cargoes	4 55@5 00
West Va. and Youghigheny gas f. o. b. at L. Point..	6 50
Kanawha Cannel, coarse.....	@

*Freight to New York $2 15.

BITUMINOUS COALS.

Kittaning Coal Co.'s Phœnix Vein, f. o. b. at Phila.....$	
Lemon " " "	
Cumberland Vein Coal.....	
Tyrconnel f. o. b.....	$7 00

Prices at Georgetown, D.C., and Alexandria, Va.

Sept. 1873.

George's Creek and Cumberland f. o. b. for shipping	$4 60@4 75

Prices at Havre de Grace, Md.

Sept. 1873

Wilkesbarre and other White Ash for Cargoes.....	$5 25@5 50
Lykens Valley	5 50@5 75
Shamokin Red or White Ash.....	6 00@6 50

Bituminous Coals (Cumberland).

Georgetown, F.o.b.....	$4 60
Baltimore "	5 00
New York "	7 50
South Amboy "	6 80

Prices of Foreign Coals.

Sept. 1873.

Duty 75 c. per ton.

Corrected weekly by ALFRED PARMELE, No. 32 Pine street, N. Y.

Liverpool Gas Oaking	— —@— —
" " Cannel	17 00@— —
" House "	20 00@22 00
" Orrel.	20 00@— —

Per ton 2,240 lbs., ex-ship.

PRICES FROM YARD.

Liverpool House Orrel, screened...	$20 00@22 00
"Cannel, "	22 00@25 00

Per ton 2.000 lbs. delivered.

Freights.—Sept. 1873

TO EASTERN PORTS.	Cumberland. From Georgetown.	Cumberland. From Baltimore	Anthracite. From Philadel'a.	Anthracite. From Elizabeth Port, Port Johnston, Weehawken, and Hoboken.	Anthracite. From Newburgh.	Anthracite. From Rondout..
Amesbury	— —	— —		— —	— —	— —
Bangor	— —	— —		1 90	— —	— —
Bath.....	— —	3 00		— —	— —	2 05
Boston	2 90	3 00		1 90*	2 00	1 15
Bridgeport	— —	2 65		1 60	1 15	1 50
Bristol	— —	— —		1 35	— —	— —
CohassetNar'ows	— —	— —		— —	— —	— —
Derby.....	— —	— —		1 25†	— —	1 40
Dighton	2 60	— —		1 40	— —	1 55
East Cambridge	— —	— —		1 95	— —	2 05
Fall River.....	2 50	2 75		1 35	1 45	1 50
Hackensack	— —	— —		— —	— —	— —
Hartford.....	2 10	3 25		1 50	— —	1 75
Hoboken	— —	— —		50	— —	50
Jersey City.....	2 10	— —		50	— —	50
Lynn.....	— —	— —		— —	— —	— —
Middletown	— —	— —		1 25	— —	1 40
Mystic	— —	— —		1 25	— —	1 40
New Bedford.....	— —	2 85		1 40	— —	1 55
Newburyport ...	— —	3 25		2 05	— —	2 20
New Haven	— —	2 65		1 00	1 20	1 15
New London.....	— —	2 75		1 20	1 30	1 35
Newport.	— —	— —		1 35	1 45	1 50
New York	2 25	2 15		50	— —	50
Norwalk	— —	2 85		1 00	— —	1 15
Norwich	— —	2 75		1 30	1 40	1 45
Pawtucket.....	— —	2 90		1 45‡	— —	1 60
Portland	2 90	3 00		1 80	— —	1 95
Portsmouth, N.H	— —	3 25		2 00	— —	2 15
Providence.....	2 40	2 75		1 35	1 45	1 50
Rockport				— —	— —	— —
Saco				— —	— —	— —
Sag Harbor.....				1 75	— —	— —
Salem		3 00		1 95	— —	2 05
Stamford				1 00	1 10	1 15
Stonington . ..		— —		1 25	— —	1 40
Taunton.....		— —		1 85		2 00
Warren.....		— —		1 35		1 50
TO RIVER PORTS						55
Albany		2 50				50
Catskill						50
Cocksackie.....						65
Coeyman's.....						20
Cold Spring.....						20
Fishkill						40
Haverstraw.....						40
Hudson		2 60				65
New York vessels						45
Nyack.....						30
Poughkeepsie...						30
Rhinebeck						—
Rondout.....						40
Saugerties						50
Sing Sing						55
Stuyvesant.....						50
Tarrytown.....						60
Troy						20
West Point.....						50
Yonkers						

†3 c. per bridge per ton in addition to freight.
† New Haven rate and towing 25 c. extra per ton,
‡ Towing from Providence and return, extra.
‖ And Towing.

St. Thomas	$— — Gold
Martinique	— — "
Demerara.....	— — "
New Orleans	— — "
Mobile.....	— — "

Foreign and Provincial Freight

Sept, 1873.

Foreign.

Newcastle and Ports on Tyne, per keel of 21 1-5 tons £
Liverpool, 5 per cent primage

TO NEW YORK.

Provincial

Sydney.....	$ 5
Lingan.....	4 00
Cow Bay	4 00
Port Caledonia	4 00
Little Glace Bay.....	4 00

TO BOSTON.

Sydney	3 50
Lingan	3 50
Cow Bay	3 50
Port Caledonia	3 50
Little Glace Bay	3 50

TO MONTREAL.

Caledonia .. .. 3 75 gold

TO CUBA.

Caledonia .. .. 9 50 gold.

Prices of Gas Coals.

Sept. 1873.

PROVINCIAL.

Corrected weekly by Louis J. Belloni, Jr., 41-43 Pine st., N.Y

	Coarse	Slack
Block House, f. o. b. at Cow Bay	$2 50	$1 25
Gowrie	2 00	0 00

Corrected by Bird, Perkins & Job, 27 South street.

	Coarse.	Culm of Coal,
Pictou.....nett	$3 00	1 50
Sydney.....	3 25	1 00
Lingan.....	2 75	1 06
Caledonia.....	2 75	1 25

A discount from the prices of the coarse Coal on purchase of 5000 tons and upwards. Duty on all slack coal or Culm : 40c. per ton of 28 bushels, 80 pounds to the bushel. On all bituminous coal or shale: 75 cents per ton or 28 bushels.

AMERICAN.	Nominal quo Currency.
Westmoreland..... f. o. b.	$9 00 @7 00
Fairmount Gas Coal Co. of N. Y..... "	6 50 @7 00
Despard Coal Co..... "	6 50 @7 00
Penn..... "	6 50 @7 00
Newburg Orrel Gas..... "	6 50 @7 00
West Fairmount Gas Coal..... "	6 50 @7 00
Redbank Cannel, at Pa ..... "	12 00 @0 00
AT PHILADELPHIA.	
Westmoreland ..... "	7 50 @0 00

Rates of Transportation to Tide Water.

BY RAILROAD.

TO PORT RICHMOND, PHILADELPHIA:

Philadelphia and Reading Railroad, from Schuylkill Haven Lump and St., net, $1 60; Br., Egg and Ch., $1 65; Stove, $1 75
Shipping at Pt. R., 20c., for use at Phil., $2 18 from Pt. Carbon.

MAUCH CHUNK TO ELIZABETHPORT.

L. V. Railroad from Mauch Chunk to Phillipsburgh.....	$0 72
C. R. R., N. J., Phillipsburgh to Elizabethport.....	63
Shipping expenses at Elizabethport.....	25
Wharfage.....	10
Total.....	$2 23

MAUCH CHUNK TO PORT JOHNSTON.

L. V. R.R., or L. & S. R.R. from M. C. to Phillipsb'g	$0 72
C. R. R., of N. J., Phillipsburgh to Pt. Johnson....	1 06
Shipping expenses.....	25
Wharfage.....	10
Total.....	$2 23

TO HOBOKEN

L. V. R. R., Mauch Chunk to Phillipsburgh	72
Morris & Essex R. R. Phillipsburgh to Hoboken,.....	6
Shipping expenses.....	25
Wharfage.....	06
Total.....	$2 23

TO SOUTH AMBOY.

L. V. R. R...	..
L. & D. R. R....	11
Cam. & Am. R. R.	11
Shipping Expenses, ...	35
Total	$2 23

PENN HAVEN TO ELIZABETHPORT.

L. V. R R. Penn Haven to Phillipsburgh	24
C. RR. of N. J. Phillipsburgh to Elizabethport... ..	1 06
Shipping expenses	15
Wharfage	20
Total	$2 35

MARKET REVIEW.

NEW YORK, Sept. 18, 1873.

IRON—Advices from abroad quote higher prices, and a firmer market for all descriptions of Iron. For Scotch Pig, here, there is a good inquiry, but the actual business is small, as at the present prices holders prefer to purchase American Pig, which it is supposed will eventually take the place entirely of Scotch ; the business has been confined to parcels to meet present wants, and we hear of no large sales, excepting 600 tons Glengarnock at a private price ; this brand is now held at $47@$48, being now all in one hand ; the stock of Gartsherrie is about 100 tons, held firmly at $50 ; Coltness may be quoted $51 @$52, stock also light. American is without noticeable change ; prices are only steady, but at present we do not think anything could be had below our quotations ; we only hear of further sales of 500 tons Gray Forge (Pennsylvania brands), on private terms. We quote New English Rails $65@$68 gold, and American $75 currency. Cash or short time sales are now very few, the bulk of the business being on long credits. Old English Rails are nominal in price, holders asking orders ; we quote D. H. $48, and T. $46@$48—100 tons sold, to be delivered at Philadelphia, at a private price. Scrap is quiet ; we quote nominally $45 from yard. Letter advices to the 30th ult. note an advance in the price of Iron in the North of England, and great activity in building blast furnaces in Cleveland. No. 3 Cleveland Iron stood at about 100s.@102s. 6d., and No. 4 at 90s. net cash, immediate delivery. The orders for Iron ship-building were scarce, and on the Tyne especially the ship-building trade was dull. In the South Staffordshire districts there was a prospect of increased coal supplies, promising an important change in the present aspect of affairs. Refined Bar from store continued steady at previous quotations. Russia Sheet is in very small supply, and higher prices are demanded, say 18@18½ cents, with a sale of 100 packs at 18, gold. There is not a pack of Stained in the market, and the crop available for this country, this year, is found to be only 20,000 packs, where 33,000 was expected—of these 11,000 packs go to Boston and have been

sold, and only about 5,000 more are expected here—100 packs domestic Common Sheet, No. 24, sold at 5¼ cents.

LEAD—Pig continues strong at previous quotations, the tone of the European markets being very firm, with higher prices demanded. Fine corroding is very firm at 7¼ cents gold, and common Foreign 6¼@7, gold—we note sales of fifty tons Spanish common, at 6¾ cents, and 100 tons domestic, on private terms, the latter strong at 6½@6¾, gold. Bar 9¼ cents, Sheet and Pipe 10½, and Tin-lined Pipe 16½, less 10 per cent. to the Trade.

COPPER—Manufactured Copper and Yellow Metal are steady at old prices. Ingot has been in continued good demand for future delivery, but spot is dull, and prices are a shade easier—the sales are 100,000 lb. Lake immediate delivery, 26½ cents, and at least 1,000,000 lb. for future delivery, at 27, cash.

SPELTER—We note sales of twenty-five tons prime Silesian at $7.70; twenty-five tons C. G. H. $7.75; and ten tons W. H. $7.87½, all gold.

Withdrawals from bond for consumption 12th and 13th September—

Germany..... plates.4,232

STEEL—There is a good demand for both English and American at old figures.

REGULUS ANTIMONY—May be quoted 13¾@13½ cents gold, with small sales.

TIN—Straits Pig continues dull, at 13¼ cents gold, with only retail sales. English is in fair request, with sales of five tons L. & F. at 28 cents, five do. Refined, 28¼, gold; and ten tons do., for shipment on private terms. Plates have been steady, with a moderate demand, and sales of 250 bxs. Charcoal Tin, at $19.62½@$10.75; 500 do. I.C.Coke, 10 by 20, $8.75; and 2000 do. Charcoal Terne, different lots, $9,87½@$10.25, gold—these last still continue in small supply

Withdrawals from bond for consumption 12th and 13th September—

Tin from England.....bxs.100

ZINC—Mosselmann Sheet is unchanged. Dealears are selling from store at 8¼ cents gold, net. Manganese black oxide 3½ currency, do. gray 5½.

METALS.

NEW YORK, Sept. 18, 1873.

IRON.—Duty: Bars, 1 to 1¼ cents ℔ lb; Railroad, 10 cents ℔ 100 lbs.; Boiler and Plate, 1½ cents ℔ lb; Sheet, Band, Hoop, and Scroll, 1¼ to 1¾ cents ℔ lb; Pig, $7 ℔ ton; Polished Sheet, 3 cts. ℔ lb; Galvanized 2½; Scrap Cast, $6; Scrap Wrought, $8 per ton. All less 10 per cent. No Bar Iron to pay a less duty than 35 per cent. ad val.

	Store Prices.
Pig, Scotch—Coltness ℔ ton	51 00@52 00
Gartsherrie	— —@50 00
Glengarnock	47 00@48 00
Eglinton	46 00@— —
Pig, American, No. 1	43 00@44 00
Pig, American, No. 2	35 00@38 00
Pig, American, Forge	31 00@33 00
Bar Refined, English and American	— —@— —
Bar Swedes, assorted sizes gold	— —@137 50
	Store Prices, Cash.
Bar, Swedes, 1⅜ to 5 x ⅜ & ⅞ 2 sq. & 6 to 12 x ⅜ & ½	175 00@— —
Bar, Refined, ⅝ to 2 in. rd. & sq. 1 to 6 in. x ⅜ to 1 in.	82 50@ 85 00
Bar, Refined, 1¼ to 6 by ¼	87 50@— —
Bar, Refined, 2⅛ to 2⅞ round 1 & 1⅛ by ¼ & 5:16	90 00@— —
Large Rounds	92 50@107 50
Scroll	102 50@135 00
Ovals and half-rounds	110 50@130 00
Band	102 50@105 00
Horse Shoe	117 50@— —
Rods, ¼ to 3-16inch	92 50@135 00
Hoop	120 00@165 00
Nailrod	— @ 9
Sheet, Russia, as to assortment (gold)	18 @ 18¼
Sheet, Singles, D. and T. Common	—5¾@— 7
Sheet, D. and T. Charcoal	—7 @— 8¼
Sheet, Galv'd, list 10 per cent, discount	— —@— —
Rails, English (gold), ℔ ton	65 00@ 68 00
Rails, American, at Works in Pennsylvania, currency	75 50@— —

COPPER.—Duty: Pig, Bar, and Ingot, 5; old Copper 4 cents ℔ lb; Manufactured, 45 per cent. ad val.

	All Cash.
Copper, New Sheathing, ℔ lb	— @— 38
Copper Bolts	— @— 40
Copper Braziers, 16oz. and over	— @— 40
Copper Nails	— @— 45
Copper, Old Sheathing, &c. mixed lots	24 @— 27
Copper, Old, for chemical purposes, 14@16 oz	— @— —
Copper, American Ingot	26½@— 26¾
Copper English Pig	— @— —
Yellow Metal, New Sheathing & Bronze	— @— 27
Yellow Metal Bolts	— @— 32
Yellow Metal Nails, Sheathing and Slat'g	27 @— 30

LEAD.—Duty: Pig, $2 ℔ 100 lbs.; old Lead, 1¼ cents ℔ lb Pipe and Sheet, 2¼ cents ℔ lb.

Spanish (gold)	6 87½@7 00
German, do.	6 87½@7 00
English do.	6 87½@7 00
Foreign, Refined	7 25 @7 37½
Domestic do.	6 50 @6 62½
Bar.....(net)	9 25 @— —
Pipe.....(net)	— —@10 50
Sheet	— —@10 50

STEEL.—Duty: Bars and Ingots, valued at 7 cents ℔ lb or under 2¼ cents; over 7 cents and not above 11, 3 cents ℔ lb; over 11 cents, 3½ cents ℔ lb, and 10 ℔ cent ad val. Store prices.

English Cast (2d and 1st quality) ℔ lb	— 18½@— 23
English Spring (2d and 1st quality)	— 9¼@— 10½
English Blister (2d and 1st quality)	— 14 @— 18½
English Machinery	— 14½@— —
English German (2d an 1st quality)	— 12½@— 14½
American Blister "Black Diamond"	— —@— 11½
American, Cast, Tool do.	— —@— 17
American, Spring, do.	— —@— 11
American Machinery do.	— 11½@— 12
American German, do	— 9 @— —

TIN.—Duty: Pig, Bars, and Blocks, 15 ℔ cent. ad val.; Plate and Sheets and Terne Plates, 25 ℔ cent.; Roofing 25, ad val.

	Gold ℔ lb.
Banca	24 @24½
Straits	24¼@—
English	— @28

PLATES. Fair to Good Brands.	Gold.	Currency
I. C. Charcoal, ℔ box	$10 62½@11 00	$12 50 @13 00
I. C. Coke	8 50 @ 9 00	9 75 @10 25
Coke Terne	7 50 @ 8 50	8 50 @ 9 75
Charcoal Terne	9 75 @10 25	11 75 @12 25
SPELTER—Duty: In Pigs, Bars & Plates,		$1.50 p. 100lb
Plates, Foreign (gold) p. 100 lb.		7 50 @—7 87½
Plates, Domestic p. lb.		8¾@—11
ZINC—Duty: Pig or Block, $1.50 per 100 lb.; Sheet 2½c. per ℔		
Sheet per lb.—10 @10½		

San Francisco Stock Market.

BY TELEGRAPH.

NEW YORK, Sept. 18, 1873.

The following reports from the San Francisco Stock Board are dated September 11th and 16th. The market is firm, with the tendency upward. The quotations, however, evince but slight alterations compared with our last.

	Sep. 11.		Sep. 16.
Savage	47	—	42
Crown Point	89	—	86
Yellow Jacket	49	—	47¼
Kentuck, "New Issue"	10¾	—	11
Chollar Potosi	39	—	40
Gould & Curry "New Issue"	12⅜	—	11¾
Belcher "New Issue"	65	—	65½
Imperial	4¾	—	4⅝
Raymond & Ely	72	—	72
Meadow Valley	16¾	—	17¾
Eureka G. V.	19	Bid.	20
Ophir	—	—	—
Hale and Norcross	—	—	—

American Institute of Mining Engineers.

OFFICIAL BULLETIN.

Announcements to Members and Associates.

I. The ENGINEERING AND MINING JOURNAL, which is the Organ of the Institute, and contains its proceedings, transactions and notices of meetings, will be sent to each Member and Associate on the payment of his annual dues. Back numbers cannot, as a rule, be sent.

II. Dues are payable in advance at the annual (May) meeting. Remittances should be made, as far as possible, by P. O. Order, payable to the Secretary.

III. The first volume of Transactions of the Institute is in course of preparation and will be sent, as soon as issued, to all members not in arrears.

IV. General meetings are held on the fourth Tuesday of February, May and October. Authors of papers are requested to notify the Secretary, in advance of meetings, of the subject and length of their papers.

THOMAS M. DROWN, Secretary.

1123 Girard street, Philadelphia, Pa.

MISCELLANEOUS.

118th Auction Sale.

90,000

TONS SCRANTON COAL.

On WEDNESDAY, SEP. 24th, 1873.

NEW YORK, Sep. 17, 1873.

The Delaware, Lackawanna and Western Railroad Company will sell, by MESSRS. JOHN H. DRAPER & CO., Auctioneers, at the Company's Sales Room, 26 EXCHANGE PLACE, corner of William Street, NEW YORK, on WEDNESDAY, Sept., 24th, at 12 o'clock, noon,

90,000 TONS

OF

COAL, FROM THE LACKAWANNA REGIONS,

of the usual sizes, deliverable at the option of the Company at their Coal Docks either at Hoboken or Elizabethport during the month of September, 1873.

The sale will be positive; each lot put up will be sold to the highest bidder; no bids, in any form whatever, being made for account of, or on behalf of the Company. The conditions will be fully made known at the time of sale.

TERMS: FIFTY CENTS PER TON, payable in current funds, on the day of sale, and the balance, within ten days thereafter, at the office of the Company.

SAMUEL SLOAN, President.

"ENGINEERING."

"The leading Engineering Journal of the world," indispensable to every Civil, Mining, or Mechanical Engineer, can now be obtained post-paid at $9 30 currency, by remitting Post Office order to NEW YORK OFFICE "ENGINEERING," 52 Broadway.

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The Largest Organ Establishment in the World.

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J. ESTEY & COMPANY,

BRATTLEBORO, VT., U. S. A.

THE CELEBRATED

ESTEY COTTAGE ORGAN.

The Latest and Best Improvements.

Everything that is new and novel. The leading improvements in Organs were introduced first in this establishment.

ESTABLISHED 1846.

SEND FOR ILLUSTRATED CATALOGUE

April 1:6m

SUPERIOR RAIL MILL.—CAPACITY: 1,000 TONS PER WEEK.

Harbaugh, Mathias and Owens,

Manufacturers of

RAILROAD IRON,

Office, corner Fifth Avenue and Smithfield Street, Pittsburgh.

Our central location enables us to draw from both sides of the Allegheny Mountains Metals and Ores best adapted for making a No. 1 Rail, and together with our Improved Machinery, are a sufficient guarantee of our ability to produce Rails of a quality unsurpassed for durability and strength, by any foreign or domestic manufacture.

New Patterns, of any desirable weight, made to order on Short Notice.

We respectfully solicit orders for New Rails, or Re-rolling. June 26,1y

United Royal Smelting Works

OF THE

Kingdoms of Prussia and Saxony.

GENERAL AGENCY:

R. J. ROBERTSON, HAMBURG, GERMANY.

REPRESENTATIVE FOR THE UNITED STATES:

H. ROBERTSON, 149 BROADWAY, NEW YORK.

During a temporary absence of Mr. H. ROBERTSON, and until further notice, all communications should be addressed to

R. J. ROBERTSON,
Hamburg, Germany.

THE ENGINEERING AND MINING JOURNAL.

ROSSITER W. RAYMOND, Ph. D.
JOHN A. CHURCH, E. M. Editors.

PUBLISHERS' ANNOUNCEMENT.

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WHILE American exhibitors received only five diplomas of honor at Vienna, no less than twenty-three were awarded to English and Colonial competitors. Among them were Messrs. HENRY BESSEMER and Co., the Broughton Copper Company, Manchester, Messrs. BROWN and Co., and CAMMELL and Co., of Sheffield, ELKINGTON of Birmingham, and the Landore Siemens Steel Company, for metal exhibits; and GALLOWAY and Sons, Manchester, LAWSON and Sons, Leeds, PLATT Brothers, Oldham, and SHARP, of Manchester, for machinery.

Ore Dressing.

OUR pages have lately contained several interesting communications on the subject of ore dressing, and some of them have touched upon the very important point of the proper translation of a certain passage in RITTINGER. Without desiring to close a controversy which may have important fruit, we have a word to say on this particular point. Mr. CAZIN is undoubtedly right in his interpretation of RITTINGER's meaning. For instance, it is nonsense to say that the Hartz ore dressers lose anything like 30 to 60 per cent., for their losses probably do not exceed what RITTINGER considers to be a fair estimate in good working—9 or 10 per cent. Their ore as it came from the mine contained, in 1871, about 6 per cent. of useful mineral, so that the mineral which escaped concentration was only six-tenths of 1 per cent. of the gross weight of the ore. This is a loss of 12 pounds in handling 2000 pounds. That is, in fact, just about the loss in wet concentration with good machines and ordinary ores. In the Hartz the ore is brought down by successive eliminations of mineral to a sand measuring ½ millimeter or 1-34th of an inch in diameter, and containing ¼ to 1 per cent. of mineral. In the summer months this cannot be treated, because the water supply is too low. It is therefore saved for the winter, and is then jigged, and even its ½ or 1 per cent. of useful mineral is mostly recovered. How is it, then, that *any* losses occur in wet concentration? One source of loss is the fact that in the earlier stages the ore is picked over, and those pieces which do not appear to have any useful mineral are thrown away, as they will not pay the cost of crushing. Some fine-sprinkled ore goes with them and is lost. Each operation also undoubtedly has its own losses. But that these are individually very small, is proved by the fact that, though the ore passes through perhaps half a dozen or a dozen operations, the sum of the total losses is only a half of one per cent. Inasmuch as it is simply impossible to break up an ore so that all particles of mineral shall be free from gangue and all particles of gangue shall be free from the heavier mineral, there must in the last operation be a loss of those particles which consist of half ore and half gangue. They show hardly a sign of value to the eye, and they pass off with the gangue, whatever system of concentration is chosen. It is difficult to imagine a smaller loss than ¼ to ½ per cent. from this cause, and it is therefore plain that the opponents of wet concentration are not fortunate in their mode of attack when they accuse it of causing undue losses of mineral. Its losses are, in fact, individually so small that they cannot be grasped, and it is only repetition that makes them at all noticeable. Those gentlemen who want to dress ore by the dry method had better confine their efforts to the improvement of their machinery rather than indulge themselves in criticism of work that is about as near perfect as anything that man does, in the treatment of ores.

Much of the difference between our correspondents rests upon a point which only one of them (Mr. KROM) has noticed, and he is decidedly in error upon it. RITTINGER says that "poor argentiferous ore" loses from 35 to 70 per cent. in concentration, according to the fineness to which it is crushed. What is "poor argentiferous ore?" Mr. KROM says that the great bulk of ores are poor, and that they form the largest mass of value. That is true; but the ores which are poor in Europe are nothing in this country—they do not come within the meaning of the conventional term "ore." On the other hand, the ores which we consider poor would be thought exceptionably rich in Europe. RITTINGER wrote for European readers, and when his sayings are applied to the American condition of things it must be done with discretion. The difference between German and American ideas of poverty in ores is strikingly shown by an example. In the "Notes" on the Hartz Works, published in this journal July 29, 1873, we find that "The mines of the Upper Hartz yielded in 1871, 154,622 tons (2240 lbs.) of ore, which by concentration was reduced to 13,546 tons of smelting ore, having a composition similar to that given above. The smelting ore, therefore, formed 8·7 per cent. of the mine ore, and the latter, as it was hoisted from the mine, must have averaged about as follows: Lead, 5·1 per cent.; Copper, 0·065 per cent.; Silver, 0·0085 per cent., or 3½ oz. to the ton." Counting the lead at 6 cents a pound and the silver at $1.30 an ounce, this ore would be worth only $10.50 a ton. But still it is not *poor* ore. A large part of the mineral consists of massive galena and pyrites, which is recovered without crushing it finer than 1 inch to ¼ inch diameter. When these sizes have been treated, the loss being really insignificant, the impoverished ore, having had more than half its useful mineral removed from it, is crushed to smaller sizes, and the high losses now begin. But these losses take place not on the ore, nor on the useful mineral in the ore, but on only a part of it, the value of which probably does not exceed 20 per cent. of the original value of the ore. By examining the course of the operations, it will not be difficult to understand how losses can be very great in some operations and yet quite minute when calculated upon the whole ore.

The present discussion, and others that have preceded it, bring out in strong light the poverty of English technical literature in a sensible and suggestive nomenclature. It is equally a misfortune that we have no *standard* nomenclature for ore dressing, which would be acknowledged by the whole profession. Our condition is similar to that of the Germans before RITTINGER's time. A number of systems were in use, many of which had no meaning outside of a very small district, and there was no commonly-received book, the use of which could gradually systematize the language of the art. But RITTINGER, in laying down the laws of ore dressing, did a hardly less valuable service when he made a judicious choice among the terms already in use, restricting them to the designation of fixed products, and thereby forming at one stroke a dictionary of ore-dressing terms which is available wherever the German language is spoken.

Among the things which it is necessary to name are the different sizes of sand, whether obtained by sorting or by separation. The terms which RITTINGER chose to perpetuate are borrowed from the domain of agriculture, and are the names of some of the grains. The largest size is an exception, being called *Graupen*, meaning "piece" or "lump;" then comes *Gries*, or "groats," a small grain about the size of oats; then *Mehl*, or "flour;" and finally *Staub*, or "dust." He made these correspond to certain groups, each containing 4 sizes of sand. We give his scale below, but are obliged to translate his names freely, and, as we know of nothing better, we will call the groups by the names *gravel*, *corn*, *sand*, *flour* and *dust*. Where the French meter measure is used these groups begin with the simple diameters of 64, 16, 4, 1, and ¼ millimeters; in English the relation is not so simple:

Gravel	64 — 22·6	millimeters,	or 2½ — 1	inch diameter.
Corn	16 — 5·6	"	or 2-3ds — 1-5th	" "
Sand	4 — 1·4	"	or 1-6th — 1-18th	" "
Flour	1 — 0·35	"	or 1-25th — 1-87th	" "
Dust	0·25	"	or 1-100th	" "

It will be observed that by using lines instead of inches a simple and easily remembered relation exists between the initiatory diameter of each group, which will be 32, 8, 2, ½, ⅛ lines. In RITTINGER's scale there is a happy correspondence between these numbers and the calculated formulæ of ore dressing; but that is a subject which we will not discuss at present.

Mr. CAZIN's argument is, that the high losses mentioned by RITTINGER are confined to the fourth group, comprising sand 1-25th to 1-87th of an inch in diameter; that the larger sizes are not subject to such losses while under treatment, and that the processes of wet concentration have been so much improved that but a small part of the useful mineral is brought down to this fineness. These assertions are undeniably true.

We will leave this subject which is under discussion by our correspondents, to correct an error we have noticed in the American appreciation of RITTINGER. He is often referred to in this country as a great inventor in the field of ore dressing, but that is his least important work. His machines were generally too compli-

cated or required too steady a supply of ore to run well, and most of them have been replaced by the simpler models which originated in the Hartz Mountains. His continuous shaking table is probably the most enduring of his inventions. Very many of the others have served no unworthy purpose by proving that the principles on which they were founded were too complicated for practical use; for RITTINGER made it his business to study every condition under which one mineral can be separated from another, and then construct a machine to use that principle. Przibram in Bohemia is a wonder to the miner, for it contains a sample of all he has done, and shows in a marked manner his noble industry, his intelligence and the untrammelled spirit which led him to search out and follow *every* path of improvement. But RITTINGER's greatest work is the book he published; for it wiped away the contradictions of all sorts, which hindered ore dressing as a useful art, and fixed it upon a firm basis as a well understood science. His labors were so fruitful that invention has since his day hardly presumed to break the boundaries he fixed for it, for he has pointed out that those boundaries are the laws of nature.

NEW PUBLICATIONS.

ON the conditions which limit the Economy of Fuel in the Blast furnace for smelting iron. By ISAAC LOWTHIAN BELL, Assoc Inst., C. E. WILLIAM CLOWES & Sons, London.

AMONG the signal services which Mr. BELL has rendered the workers in iron, his inquiry into the theoretical minimum of fuel required to produce a ton of pig iron, was one of the most important. An impression had gained ground among some iron masters that if the right shape and size of furnaces could be found, the amount of pure coke required per ton of metal might, with average ores, be very much lower than it is now. This view was sustained by some scientific men, but combated by the author of the paper before us. His conclusions were based on two facts, first, that the product of combustion in the blast furnace is carbonic oxide, CO, and more complete combustion cannot be permitted without destroying the strong reducing action which now makes the blast furnace one of the most beautifully complete instruments in the hands of the metallurgist.

The other general fact is that the most thorough-going improvements in construction and use of the furnace, cannot effect economy in all the heat consuming operations; there is, for every ore, a "constant requirement" of heat for the chemical operations which takes place, and, next, a "a variable requirement" of heat, the amount of which depends upon the furnace and its belongings. It is evident that the first or chemical requirement is one that improvement cannot effect. All efforts to economize fuel in the blast furnace process must be confined to the second, or that requirement of heat which is demanded by the character of the mechanism employed. The reasoning was combated or, perhaps we should rather say, it was *neglected* by some who were unable to believe that the improvement of the blast furnace had now reached a working limit; and this paper is a reiteration of Mr. BELL's conclusions. He goes over his calculations again, reasserts the correctness of his views upon some of the reactions in the furnace, and maintains that the high furnaces of the Cleveland district have produced a working maximum of economy.

The differences between Mr. BELL and his critics are chiefly those which relate to the hot blast and the proper height of the furnace. One of the most important of his theories is that heating the blast adds nothing to the operation, that an equal amount of heat, added in any other way, would not produce. Other thinkers consider that a hot-blast increases the vigor of production, or the heat of the hearth, or intensifies the heat throughout the furnace, or else adds in some unexplained way to the action of the fuel and the rapidity of the operation. These gentlemen labor under the disadvantage of indefiniteness. Mr. BELL roundly asserts that the hearth temperature is precisely the same in a cold blast, as in a hot blast furnace; the ore, flux and quality of pig being equal. The only difference is in the amount of solid fuel burned, and the rapidity of the operation. In England the main point is to attain the utmost economy of fuel, and he therefore neglects the question of greater or less rapid fusion. As to fuel, he claims that all the economy in fuel produced by a hot blast, can be obtained by simply adding to the height of the furnace.

The reason for this is that in a hot blast furnace there is a smaller volume of gas per ton of iron than in a cold blast, because part of the heat is mechanically added instead of being obtained by the combustion of a corresponding amount of coke in the hearth. The gas being in smaller volume moves at a slower rate, is longer in contact with the ore, and therefore prepares it more thoroughly. If now we heighten the furnace instead of heating the blast we produce just the same longer contact, because we provide a longer path for the gas. A high cold blast furnace prepares its ore for fusion in the hearth just as well as a low hot blast furnace. It is therefore a question which mode of improvement the iron master will choose. As is usual with practical men in such dilemmas, he has chosen both methods, nearly all furnaces are now blown with hot air and it is comparatively rare to find a new furnace built in the dimensions which were common a few years ago. But there is a limit to both methods. It is safe to say that furnaces above 80 feet in height have not approved themselves, but there is as yet no such concurrent experience in regard to a very hot blast. Mr. BELL's voice is that of a prophet who declares that the temperature of the blast has its limit too, and that limit he puts at about 900° F. (485° C.) Not only does the difficulty of managing the blast increase very rapidly as this limit is passed, but there is positively no gain but rather a loss of fuel by the use of such a temperature.

This apparent contradiction rests upon the fact that successful work in the blast furnace requires a certain equilibrium in the chemical operations which go on within it. The furnace gas is a mixture of carbonic oxide and carbonic acid. If the temperature near the top of the column is kept sufficiently low, the carbonic acid exerts only a moderate dissolving action on the coke through which it passes. But if this temperature is increased to any important extent the coke suffers solution in larger measure, and this operation both causes a direct loss of fuel and it is also a heat absorbing operation. Mr. BELL maintains that in a furnace of proper height any temperature of blast above 900° F, would produce this undue heating of the gas and materials, and waste of coke by solution in carbonic acid would consequently be inevitable. His view is combated by Mr. SIEMENS, Mr. WHITWELL, Mr. COWPER, and other well known metallurgists, but it has one advantage which will recommend it to blast furnace proprietors. It encourages the use of comparatively moderate temperatures which are much less troublesome to obtain and manage than those which are 300 or 400 degrees higher. His is conservative ground, and he brings forward so much well considered proof that his opponents find it hard to meet him with argument for argument.

ILLUSTRATED CATALOGUE OF B. F. STURTEVANT'S PRESSURE BLOWERS. SMITH & PORTER, Printers. Boston, 1873.

Mr. STURTEVANT states the production and sale of his fan blowers at 250 a month. They are so well known that it is hardly necessary to go into a description of them. Careful calculation and excellent workmanship have made them so efficient that it is safe to say they surpass every other fan in economy of power and in a maximum delivery of air. This catalogue is not merely a list of prices but contains calculated results for each size of blower. Of the pressure blowers there are 10 sizes, delivering from 324 to 8880 cubic feet of air per minute. Exhaust fans, hot air fans, multiplying pressure blowers and gas exhausts are also described. Mr. STURTEVANT is also a maker of gearing and blast pipes of the best kinds. But the principal value of the present catalogue—to the engineer at least—is the tables which contain those calculations of speed, corresponding amount of air delivered, horse power, etc, which are so often desired, but which are sometimes troublesome to make. We wish Mr. STURTEVANT would add to his table of velocities and amount of air, one giving the results of slower work. His fans are often found attached to one small furnace, and if the smelter does not want to blow his fire out he has to slack up his engine. We have seen his No. 2 blower running at 1500 revolutions, No. 1 at 1200, and so on, and in neither case could the smelter find out how much air he was using. Of course that state of affairs is wrong, but it exists, and Mr. STURTEVANT can help out many a deserving metallurgist in the west by adding a little to his tables. In this catalogue will be found tables of the proper width and speed of belts; for equalizing the diameter of pipes; and illustrations of the best modes of connecting the blower with the system of pipes. It is a very useful assistant to those who have to use fans.

THE JOURNAL OF THE IRON AND STEEL INSTITUTE, Vol. I., 1873. London: E. and F. A. SPON, Charing Cross, London.

This volume contains the opening Address of the President, I. L. BELL, eight papers read before the Institute, the plates which illustrate them, and the regular reports of proceedings, report on foreign metallurgy, etc. This is by all odds the most important yearly publication in the world of metallurgy. Its scope is confined to the industry connected with one metal, but that metal is much the most important known to man.

CORRESPONDENCE.

Concentration—Wet or Dry?

TO THE EDITOR: SIR—An article on "Concentration" was published in your journal August 26th, written by Mr. F. CAZIN, M. E. The writer engages in the controversy on the side of the wet system, and deems it essential that he should attack me personally rather than limit the discussion strictly to the question of wet or dry concentration as a purely scientific problem in which there is now great practical interest. It will not be disputed that a writer who undertakes thus to sustain his side of a controversy by criminating an opponent should be extremely cautious in regard to the fairness of his comments and the truth of his statements, lest he should himself be convicted of malice as well as falsehood. I propose, as briefly as possible, to apply this as a rule to test the character of the article in question as well as that of its author.

As if to impress the reader with the writer's fairness and deliberate study of the matter, the first paragraph plainly states: "Before me lies an extensive pamphlet—description of S. R. KROM's system and machinery for dry crushing and concentrating ores—also a letter, dated June 9th, from Mr ALEXANDER TRIPPEL, the well-known metallurgist;" but in the next paragraph such impression is falsified by quoting, for the chance of perverting, some lines written by Judge BAKER with reference to the difficulties involving all who "teach theories different from those held by the learned of their times;" the intent of the perversion being to make it appear as though I had courted a resemblance to Copernicus and Galileo, and then ending the third paragraph as follows:

"Mr. KROM is not the inventor of the idea of dry concentration, patented by him in 1868, as is fully proved by GÄETZSCHMANN'S Aufbereitung, published in 1864. Mr. KROM, in defending the idea with which he unjustly identifies himself, does not stick to truth and veracity as the two martyrs of scientific truth did, but he misrepresents documents, thereby giving undue prominence to his system."

I. As if affirmed by me in the pamphlet before him, Mr. CAZIN denies that I am "the inventor of the idea" which he says "I patented 1868," although such claim was disproved in Germany in 1864. Now, what were the facts before Mr. CAZIN? It is nowhere affirmed in my pamphlet that I claimed to be "the inventor of the idea of dry concentration," on the contrary, I distinctly say the opposite on page 16, where I state that "hundreds of thousands of dollars have been expended (to my knowledge) in attempting to produce a simple and de-

sirable machine that would, by such means, closely and economically accomplish, in all cases, the dry concentration of ores." Nor is it true, nor anywhere intimated in my pamphlet, that I "patented the idea;" but I did patent *a machine* in 1868.

II. The charge of "unjustly identifying myself with the idea I defend," shows that all of the "Innocents" are not "abroad;" but what follows would be dishonorable in me if proved, or, being unproved and unfounded, Mr. CAZIN must stand convicted of a most unwarranted attempt to wrong me among the readers of the JOURNAL. I allude to the words "does not stick to truth and veracity but misrepresents documents," since this a charge never made by an honorable man unless under the exigencies of positive proof.

Mr. CAZIN opens on this point in the following style: "Carefully examining the contents of the description of Mr. KROM'S process, and developing his reasoning back from thesis to thesis." By this exhausting study he arrives at two conclusions. First, I don't stick to truth and veracity, because I quote KÜSTEL'S translation of RITTINGER'S German, and KÜSTEL'S translation is not like CAZIN'S translation. Second, I misrepresent documents, because I quote KÜSTEL'S translation of RITTINGER'S German, and KÜSTEL'S translation is not so good as CAZIN'S translation. Then we are told "to this citation (my quotation) all deductions made in favor of dry concentration are directly or indirectly referable." That is, my conclusions are wrong because he differs from KÜSTEL whom I quote; KÜSTEL being a German born, a celebrated metallurgist and author of a work on wet concentration, perhaps the best compendium on that subject published in America. Is his admitted ignorance of a well-known American writer a sufficient reason for charging me with falsehood and worse, because he thinks his (Cazin's) understanding of the German language is correct, and that of Mr. KÜSTEL is not correct?

Before he proceeds, however, to show me up, he indulges in some of RITTINGER'S lore on the philosophy of wet concentration, as to shapes and specific gravity of particles, doing so for the purpose of saying that I am ignorant on this subject, notwithstanding that the pamphlet which he had "carefully examined, developing back from thesis to thesis," on page 10 discusses the same subject. Having said this, he indulges in that pleasing theoretical delusion common to all water dressers which has never been realized in practice, viz., that "wet separation soaks up the dust as well as the grains and *separates* (?) the mineral dust from the waste dust" by so and so, this way and that way, until finally "by filtering the water in the jigging action before it leaves the apparatus....the heavy material must be and is saved!"

Then Mr. CAZIN opens again on me, "Let us see now what citation Mr. KROM makes from RITTINGER in order to do away with all RITTINGER'S labors and replace them by his own." To show this, KÜSTEL'S language is said to be mine, and the CAZIN translation is set aside of it as follows:—

KÜSTEL—"The average loss at large of poor argentiferous ores in concentration (by water) is"—

CAZIN—"Poor argentiferous ores under treatment by stamps will lose in total average according to experience collected."

It will be seen that the sense is precisely the same, KÜSTEL leaving out "treatment by stamps" for mere brevity.

KÜSTEL translates, Bei den raschen Mehlen auf 40 per cent.—"with coarse sand 40 per cent."

CAZIN translates same—"out of the resulting quick flour 40 per cent." KÜSTEL translates Bei den mittleren (flauen) Mehlen auf 35 per cent—"with middle fine sand 35 per cent." CAZIN translates same, "middle (slow) flour 35 per cent." Both translate, Bei den Schmanten auf, "Slimes 60° to 70°." Here it will be seen by any ordinary reader of the English language that KÜSTEL'S translation is good sense and Mr. CAZIN'S nonsense, requiring to be again translated—since the "resulting quick flour" and the "middle slow flour" are, at best, technical expressions, meaning pounded ore particles quickly, and less quickly, falling in the water used for concentration, as "coarse sand" or "middle fine sand" do. Both thus to be distinguished from the dust, "slimes." Out of this, however, he makes his charge of misrepresenting documents, when he knew if error there was, the error was KÜSTEL'S, not mine.

But further than this Mr. CAZIN has allowed his temper, or his ignorance, to lead him into a still graver offence, extending to a misconstruction of the whole matter, in order that he might upset "all deductions made (by me) in favor of dry concentration." He says that RITTINGER would turn in his recently-shut coffin could he hear such abuse of his name, thereby meaning that I have misstated the losses according to RITTINGER by wet concentration so as to show the losses by dry concentration to be greatly more favorable. Here again it is KÜSTEL that is wrong and not only he, but also all other candid water dressers, as well as the working experience everywhere throughout the United States, are wrong if Mr. CAZIN is right. KÜSTEL says that according to RITTINGER, "the average loss at large of poor argentiferous ores," (that is when no further selection can be made previous to stamping; therefore, the great bulk and the largest mass of value are "poor argentiferous ores.") by stamping and then concentrating, is as follows:

Products of stamping.		Loss by concentrating.
Coarse sand	32 per cent.	out of which mineral loss 40 per cent.
Middle fine sand	32 " "	" " " 35 " "
Dust	36 " "	" " " 60 to 70 " "

These figures are RITTINGER'S and they mean precisely as stated, but Mr. CAZIN says otherwise, and undertakes to show that "poor argentiferous ores" yield up 90 per cent. of their metallic value by some mode not described, leaving only "*about* 10 *per cent. of the entire bulk after crushing*" and it is out of this 10 per cent. that "*Rittinger averages the loss at* 40 *per cent. of the metallic parts contained in the rock.*" Thus very strangely taking all the loss out of the "coarse sand 40 per cent." *i.e.*, his "resulting quick flour." By calculation, supposing the poor ore to be worth $50 per ton, on his basis $45 are first all saved, then the balance, $5, is in the "Resulting quick flour" of which the loss is 40 per cent., viz. $2. Of course here is perfection. No loss is charged to concentrating the "middle fine sand" or "middle slow flour" and none to the "dust" or slimes!

Then, if this is the actual fact, why is it that writers, operators and owners of ore continue to deliberate the enormous losses sustained in treating poor argentiferous ore? And, above all things, *why* is it that certain water jig inventors wrong the public with new inventions which are advertized as improvements upon RITTINGER'S perfection, $2 per ton loss only,—FOUR per cent!!

But is Mr. CAZIN supported by anybody?

KÜSTEL says "not all kinds of silver ore can be concentrated—it is generally a most delicate operation, being subject to heavy loss which cannot be avoided"—"It is therefore quite proper to calculate on a loss of 35 per cent. in treating silver ores, "*provided the plan of concentration is the proper one.*"

The best wet concentration works on the Pacific coast show in published reports a loss of 38 per cent. and it is said their actual loss was very much greater.

The Salt Lake *Tribune*, speaking of certain works, says: "By the most approved method of wet concentration *seventy-five* per cent. of all silver was lost."

Is it worth while to quote further?

Mr. CAZIN having so satisfactorily proved the loss to be only four per cent., comments as lucidly on what I have termed "*floating dust*," and also on "the adhering of small particles of mineral to the gangue" both of which being sources of loss in dry concentration, exclaiming, "what does all of this mean? The dust which RITTINGER describes to sustain a loss of 40 per cent., is all, totally, considered as loss by Mr. KROM in his process and all metallic parts adhering to gangue matter is lost." Now he changes base, calling my "floating dust" his "resulting quick flour" (40 per cent.) all of which, he says, I consider as loss. I don't say so, but if it was all loss, the calculation would show in my favor. CAZIN admits the 40 per cent. loss of RITTINGER; this is out of 36 per cent. of the ore. Now my "floating dust is never beyond *five per cent. of the ore;* now would it not be better to lose five per cent. of all than lose 40 per cent. in value out of 36 per cent in weight? The adhering particles are sources of loss in wet or dry concentration, BUT LESS IN THE DRY.

Up to this point Mr. CAZIN has shown one kind of disposition now he shows another. This happens with respect to a quotation from the letter, dated 9th June, from Dr. TRIPPEL.

"I wish to inform you that I have seen the establishment in Star City, Humboldt County, constructed by Mr. KROM. He was at the place himself and directed the work. The results were very satisfactory for an establishment based upon a comparatively new principle. * * * * By the dressing of the mineral it was condensed from $50 per ton to $1200 per ton, with tailings of $11 and the flour (dust) not counted, which admits no other treatment in dry concentration but was left for eventual smelting or amalgamation without further concentration."

It is a matter of much regret to me that Professor TRIPPEL should have been thus unpleasantly dragged into this controversy. Suffice it for me to say that the Professor has not been to see the Star City Mill, and moreover, never *intended* to convey any such impression to Mr. CAZIN.

The point intended by Mr. CAZIN is the assumption that Dr. TRIPPEL *saw the works, got the samples, made assays and obtained the above results.* Before I left there were some assays made—none since. The facts are as follows:

The original ore assayed $54.56 per ton.

1st grade of tailings 45 p. c. of the ore, assayed $3.23 per ton, value per 900 lb.	$1.44
2nd grade of tailings 30 p. c. of the ore, assayed 3.67 per ton, value per 600 lb.	1.10
3d grade of tailings 15 p. c. of the ore, assayed 8.00 per ton, value per 300 lb.	1.20
Floating dust..... 5 p. c.....	
Concentrated mineral 5 p. c.....	
Showing an actual loss of not quite 7 per cent., or.....	$3.74

The concentrations, in grades, assayed $12.19 - $15.00—$16.60 per ton.

The dust saved by the dust contrivances amounted to about 5 per cent. on the whole mass, hundreds of tons, treated. It is not susceptible of concentration by air or by water. It is sold at the price of ore of like value, but even if all lost, the whole loss would not reach 12 per cent. of the original assay of the ore.

A gross misstatement is reached in this way, which, even if true, ($11) would prove nothing against the dry work. These ores of Star Canyon are deemed the most difficult to concentrate, being composed of argentiferous galena, zinc antimony, black sulphuret of silver, chlorides, etc. Their concentration *by water* had totally failed, a loss, as I was informed, being made reaching as high as 75 per cent. In comparison a loss of $11 per ton by air would be a large gain. *In consequence of this great loss by water, the proprietors of the ore were willing to contract for the return of* 80 *per cent. of the assay value, thus allowing for a loss of* 20 *per cent. as the margin for the mill loss by dry concentration.* The mill worked on this contract and saved on the margin allowed as inevitable loss, more than 10 per cent.

The Star City mill is not owned by me, hence the poverty of the records in behalf of my system, the owners having their own objects to subserve. Suffice it for me, they are so well satisfied, that new mills elsewhere in Nevada are in contemplation. The neighborhood is fully convinced of the success in saving where water dressing would be ruinous, and visitors are strongly impressed with the entire correctness of the method. In confirmation of this, it is only necessary for me to say, that this practical demonstration has caused contracts to be made with me for California and Arizona upon which a large advance has been paid and the machinery ordered.

In view of these and like solid proofs of the superiority of my system, in actual working, I must be excused from again noticing opponents who attack without discretion and stoop to deception and worse means of discrediting what must after all be judged simply upon its merits. My system is now fully before the public, it is open to all just and fair criticism by those who must naturally cling to what their education fits them to sustain, and cannot be put down unless by its own failure. I am now free to say that while I have at no time claimed to be the inventor of the "idea of dry concentration," I may now justly say, for the first time, that the Krom Dry Ore Separator is the first and only perfect machine which successfully employs air as the concentrating medium. S. R. KROM.

Iron and Steel Institute at Liege.

ABSTRACT of the President's Address, continued from page 185.

Along with this change in the cost of living, wages had also risen at the period of my inquiry (1867); so that, speaking generally, it may now be assumed the prices of food and wages in the three countries under consideration, occupy an intermediate place between Great Britain and those countries where the population is almost exclusively engaged in tilling the land. [Mr. BELL here gave a comparative table of wages in England, France and Belgium, which we omit.] GRUNER and LAN, in their very comprehensive and able work on the state of the iron manufacture of England, written in 1862, mention, in regard to wages, that labor, which in France costs one franc, commanded one shilling with us. Without knowing their opinion, I arrived at the same conclusion as regards France, and the same difference appears to obtain in Belgium and Germany when compared with the rates then prevailing in Great Britain. I shall not venture to express any views on the future of the labor market in either the British or Continental iron trade. As you are all aware, within the last year or 18 months, under the influence of an unusual demand for every species of industrial product, wages have experienced, generally, the most extraordinary and unlooked for changes. In the iron works with us it may be taken that the rates of to-day are 50 per cent. above those of 1871. So far, however, as I have been able to ascer-

tain, the increase which has taken place on the continent is not above one-half of that which has been conceded by the English and Scotch iron masters.

The class which is directly benefited by an augmentation in the value of the product of the soil, is, of course, the agriculturist, and it might be thought that so far as the exportation of provisions tends to raise the cost of living in the exporting country, the manufacturing interests derive the reverse of any advantage from the change. Against this, however, we have the admitted fact that concurrently all branches of industry in western Europe have progressed with strides unknown in the world's previous history. As regards iron this is strikingly true, and in spite of any increased cost of production due to higher wages, improvements in machinery, and in some of the processes themselves, have, until very recently, enabled the iron master to deliver the metal to the consumer on as favorable terms as formerly. Leaving the present abnormal condition of industrial affairs on one side, and confining ourselves to the relative state of the manufacture of iron in Great Britain and on the continent, as it existed two years ago, and for some time previously, the obvious question arises as to what the supremacy of the former is due, in the matter of quantity produced. In the actual cost of a given amount of labor we stand in an admittedly less favorable position than our colleagues in Belgium, France or Germany. Do we possess greater natural advantages in the possession of raw materials than they? is the question to which I propose shortly directing your attention.

In respect to ore, many difficulties intrude themselves in the inquiry, due to great differences which exist in the facilities attending the extraction of the mineral and its conveyance to the furnaces in different localities of the same State. As an example, in our own country the cost of ore on a ton of iron varies from 12s. to 40s. So it was in France, speaking of it before the war with Germany, where iron stone, yielding 35 per cent. of metal, was delivered at the furnaces at less than 3s. per ton, while at other works a ton of iron cost 44s. for the ore they were smelting. The relative advantage enjoyed by either nation must, therefore, be determined by the proportion of the cheaper and dearer varieties consumed. After a very minute investigation on this point, Gruner and Lan, in the work already mentioned, settled the average difference in favor of France, at 8s. (10 fr.) on the ton of pig iron; and according to these very competent authorities, Belgium is stated as being then equally favorably situated in respect to the cost of its ore. The German works on the Rhine have to deal with somewhat more expensive sources of iron than either of the other two countries, but this inferiority of position is partly neutralized by cheaper fuel, as will shortly appear.

And now a few words on the question of coal, which, during the last twelve months, has proved an object of such absorbing interest to the whole civilized world. Of this material of the iron makers' art, Great Britain furnishes, in round numbers, twice as much as Belgium, France and Germany put together. This she is able to do by virtue of the number and extent of her coal fields, but it is a fallacy to suppose the iron trade of the British empire has expanded to its present proportions in consequence of coal being worked much more cheaply than is the case in the three other states with which we are comparing it. To place this clearly before the meeting, I will give the cost given me of raising a ton of coal in different places during visits paid in the year 1867 :

	Average.
Belgium—5s. 7¼d., 7s. 1¼d.	6s. 4½d.
France—3s. 0½d., 4s. 2d., 4s. 9½d., 5s., 5s. 2½d., 6s. 0¼d., 6s 7½d., 6s. 9¾d	5s. 4½d.
Germany—Rhenish Prussia—4s. 8d., 4s. 8d., 4s. 9½d 5s., 5s. 7d	4s. 11½d.

In Great Britain, at the same time, we should probably not be far from correct in accepting 4s. as the average cost of delivering the fuel at the pit's mouth in the chief iron making centers of our own country. To all these figures has to be added the cost of conveying the coal to the iron works, and this, in the case of Belgium and Germany generally, will be done as economically as with ourselves, inasmuch as the furnaces and mills, like our own, are placed on the coal fields. In France, on the other hand, the fuel has occasionally to be transported considerable distances, but in some cases the iron works are established near the coal mines. The expense of transport in this last named country sometimes amounts to as much as 8s. (10 francs) per ton; but this high charge is usually met to some extent by an advantage in the price of the ore.

The truth, however, is that if we wish to arrive at a sound appreciation of the subject under discussion, we must dismiss from our minds all question of cost, and confine our attention to the market value of coal, a value which, of course, is determined by the relation borne by the demand to the means of meeting it. In France, the supply is so far below the requirements of a large nation that a considerable deficiency has to be made up by importations from abroad, incurring thereby a heavy charge for carriage. Coal under these circumstances was, according to Gruner and Lan, fully double the price it commanded in England in 1862. The difference between the cost and market value at the pit I found, in 1867, was from 4s. 6d. to 5s. per ton. Belgium and Rhenish Prussia, on the other hand, are both coal exporting countries, and were able to raise the mineral at the period we are considering, in such quantity that the margin between the cost of production and sales was from 2s. to 2s. 6d. per ton in the former, and from 2s. 3d. to 2s. 9d. in the latter. Ore costing, according to the French authors referred to above, 8s. less on the ton of pig iron than the average of that smelted in Great Britain, gave this country, with its cheaper coal, in 1867 an advantage not exceeding, on our entire make, a few shillings per ton over Belgium; and in Rhenish Prussia the lower price of fuel would go far towards enabling the German smelter at that time to work as economically as the manufacturers near Liege and Charleroi. Thus it will be seen from what has preceded that Great Britain owes the pre-eminence she has hitherto enjoyed as an iron making nation not so much to her ability to work coal greatly below the cost of that obtained from the mines of Belgium, France, or Germany, but because she possessed what hitherto may be regarded as unlimited powers of production in respect to her fuel.

A complete revolution in prices has occurred since the date of these comparative estimates. Notwithstanding the enormous coal producing powers of Great Britain, the demand upon its resources has overtaken, indeed gone beyond, its present means of supply; and to the infinite amazement of every one the selling price of furnace coke rose in the chief seat of its manufacture, viz., the County of Durham, to about double that charged two years ago to the least favorably situated iron works in France. It may be further observed as a fact worthy of notice, that according to the prices current of the day, coke is as dear in the North of England as it is at Charleroi. Included in the requirements made on the British coal fields are some fifteen millions of tons taken by foreign countries, a quantity which it is needless to say is far in excess of the deficiency which has been the cause of fuel rising with us to fully three times its former figure. Leaving on one side the imprudence, indeed the impossibility, of such a change in our commercial policy as that of forbidding the export of coal, it is open to us to imagine the probable result of such a course of action. The 15,000,000 tons would be thrown on our hands, and the continental iron masters would have to compete with those of our country, the latter drawing their supplies of fuel from an overstocked market, and the former from one with coal at famine prices. It may be alleged, and with reason, that the recent exorbitant prices are opposed to the public good, but we must look to the natural course of events and not to legislative interference for working the cure. What I would respectfully submit is that most instructive lessons in the all-important science of political economy are involved in the experience of the last year or two.

During the meeting Mr. BELL announced the presence of Mr. RAYMOND, President of the American Institute of Mining Engineer, who, officially, extended to the Institute the invitation to visit the United States, voted at the last meeting of the American society. This invitation was accepted provisionally, Mr. BELL saying that a circular would be issued to the members of the Iron and Steel Institute, to ascertain their views upon so important a step. Mr. RAYMOND also exhibited Prof. HITCHCOCK's geological map of the United States.

The Trial of Peat at Ishpeming.

THIS effort to smelt iron ores with peat continues, and we copy from the *Iron Age* the following correspondence on the subject. We believe that some artificial preparation of the peat is made by subjecting it to the action of superheated steam, but it will be observed that this correspondent does not mention any such process.

Perhaps the most interesting things to be seen in the district, in connection with iron smelting, are the furnace and peat works of the same company at Ishpeming. The original dimensions of this furnace were: height, 20 feet; diameter at boshes, 6 feet 7 inches; but it has just been enlarged to 43 feet in height, and 9 feet wide at the boshes. In its former condition a run of fifteen days duration was made on peat alone, and 200 tons of iron were made with it, but from the fact of the furnace not being well adapted to its use, and from want of proper experience as to its action, a salamander was produced, and the furnace had to be blown out. Another attempt will now be made to use a mixture of one-half peat and one-half charcoal. The furnace has been completely rearranged, and all of the apparatus is of a good order. The waste gases are taken off at each side of the furnace, below the discharging apparatus, by flues, and led down to the boiler at one side, and to the hot blast ovens at the other. Horizontal blowing engines are in use here, the blowing cylinder being 34x40 inches in size, and the steam cylinder 12x22 inches. A pressure of blast of from 1½ to 2 lb. will be used. The furnace is provided with three tuyeres, only two of which will be regularly used; in case of its being necessary to use coke or anthracite, the other will be brought into play.

The gas flues have all been much enlarged, as peat gives a much greater volume of gas than other fuels. Under the single boiler in use, which is 44 inches in diameter and 24 feet long, is a bridge wall communicating through its ends with the external air, and having holes pierced through its back to provide an additional supply of air for the combustion of the gases. The furnace itself is constructed of masonry up to a few feet below the top, where it is iron jacketed.

The peat excavations and drying beds are quite interesting. The deposit of this material hereabouts is very large, extending through from Lake Michigan to Lake Superior, a distance of 150 miles. In the present workings at Ishpeming the bed is about eight feet in thickness, but further in the bog it has been found to be over twenty feet in depth. The excavation is conducted with very little labor, one man being able to take out about twenty tons in a day, at an expense of 50 cents per ton. The workings are kept dry by keeping one side higher than the other, and pumping out the water which accumulates on the lower side.

There are two different varieties of peat in the deposit; that nearest the surface shows the fibre of its components quite plainly, but that which is deeper in the stratum, called from its appearance "liver" peat, is perfectly homogeneous, and when dried strongly resembles cannel coal. Let any one who discredits the theory of formation of coal beds from the peat bogs of the carboniferous age,

visit these or similar deposits, and he cannot fail to be convinced of its correctness.

The peat is loaded into cars in the excavation, and hauled up a long incline, by engine power, to the dump, where it is led into a cutting mill, consisting of a horizontal cylinder with projecting knife blades, revolving in a cylindrical box. In this the fibre is completely destroyed, and much of the water removed. It is then carried to the drying floors, which consist of a series of rectangular beds of plank with sloping sides, between which run the tracks and walks. The plank used in the construction of the beds is of unsaleable quality, and the bed rests upon logs, so as to allow of the circulation of air through the material, which is spread out in a layer from 1 to 2 inches thick. It soon settles down to an even surface, and after being left for several days exposed to the air, cracks up into pieces which are then turned over or set on edge. From 7 to 10 days are required for thorough drying, ordinarily, though, of course, wet weather will retard the operation. At the end of this time the peat is comparatively dry and hard, but is still unfit for use, and is placed in store houses roughly constructed of inferior planking, with open joints in the sides, but water-tight roof. Along the center of the floor, which is supported on logs, runs a flue of triangular section, built of slats with open joints. The air entering this can circulate upward through the mass in every direction.

One hundred and ninety thousand square feet of drying surface are now available, which will be increased to 300,000 square feet, should their experiment in the furnace prove successful. With the latter amount about 75 tons can be produced per day. The expense of the entire operation, including excavation, will be $2 50 per ton, and it will cost 50 cents more to deliver it at the furnace.

When well dried, this peat weighs 35 lb. to the bushel. It is quite hard and compact, and upon a smooth surface will receive a fine polish. It is really surprising, indeed, that in this simple manner, without the use of pressure, so good an article can be made.

About 60 bushels of peat, in admixture with the same quantity of charcoal, will be required per ton of iron produced.

Thus far the enterprise has attained to no decisive results, but its movers are hopeful, and willing to give capital and time to its development, and when we consider that the mode of preparing peat is as yet imperfectly understood, as well as its application to smelting purposes, it is reasonable to hope that some day it will be economically applied. Meantime all will watch for the result of this experiment with great interest.

Rock-boring Machinery.

"ON THE DIAMOND ROCK DRILL."* BY MAJOR BEAUMONT.

All new applications of machinery must, in these times of high-priced manual labor, have a peculiar interest, especially to such a body of practical gentlemen as that which I now have the honor to address; and the application of the diamond to the general purposes of mining will, I think, be allowed to be producing results well worthy of your attention. I appreciate fully the value of time, and shall, therefore, proceed at once to my subject, without making any introductory remarks, or referring to other means of doing the same work as is done by the diamond drill, except so far as may be necessary to explain the difficulties which it is asserted the system under discussion overcomes. The patents for the diamond drill are extensively worked by the Diamond Rock Boring Company, the results previously obtained having removed the system from the category of experiment, and established it as a recognised and practical success. As a rule the company neither sell machines nor let them out on royalty, but contract, at a fixed price, for the execution of work. The business taken up by the company divides itself into four classes, in some of which a greater advance has been made than in others.

1. The sinking of boreholes for the purpose of testing or prospecting for minerals.

2. The driving of drifts, galleries, and tunnels, whether for mining, water works, or railways.

3. The sinking of shafts.

4. The removal of subaqueous rocks by blasting.

All of you will have a general idea of how these operations are carried on. Still, in order to enable you to value the results obtained with the diamond drill, I shall recall the leading features of the position in which the application of machinery stands with reference to them.

1. Boreholes are ordinarily put down by giving a reciprocating motion to a chisel attached to the ends of rods, lengthened as the hole is deepened, the débris being brought up by means of shells or augurs. This reciprocating motion is given by manual labor or by power. A considerable difficulty and risk attends giving even a very moderately rapid reciprocating motion to a long column of rods, and to get over this difficulty, and facilitate their withdrawal, Messrs. MATHER and PLATT have constructed machinery whereby the cutting is done by the fall of a tool suspended from a rope, the great point of gain being the speed at which the necessary tools either for cutting or removing the débris can be lowered to their work and withdrawn. Attempts have, moreover, been made to apply a rotary motion to steel cutters, but even in soft rock the progress so obtained has been extremely slow, because no steel can be got which will withstand the abraiding action of the rock.

2. Headings are ordinarily driven by drilling holes and blasting them. Machinery is applied to the drills by attaching them to pistons, actuated by compressed air in cylinders, a supply of water to clear the débris and cool the tool being used. The air is distributed by a valve or valves, driven by suitable mechanism, and a rotating motion is given to the tool to obviate its striking two blows in the same place. All the percussive systems of boring machines in actual use come under the above description, varying in the greater or less degree of mechanical skill with which the parts have been arranged.

Some machinery has been made which proposes to drive tunnels at one operation, entirely by machinery, and without the use of powder; but hitherto, so far as I know, only a few yards have been so driven experimentally.

3. Drills similar to those applied to tunnel driving have been used for shaft sinking, but only singly, and I have not heard of any case where the speed of the sinking has been notably increased

4. The putting down of blast holes under water has always been considered a most difficult operation, because a blow cannot be struck under water, and I have never heard of machinery being applied in this direction at all. I saw the Suez Canal rocks being removed by blasting, but the holes were put in by ordinary churn jumpers, worked from barges anchored in the stream.

The diamond drill is in principle quite distinct from any other system of holing rock, and works by rotation without striking a blow. Its action is rather that of abraiding than cutting, and the effect is produced by the sheer difference in hardness between the diamond and the rock it is operating upon. There is really no comparison between the hardness of the diamond and that of ordinary rock. If a diamond be kept rotating against a piece of sandstone it would cut a hole, say a mile deep, before it was seriously worn. It will be seen at once that if this wonderful resisting power be properly taken advantage of, a machine can be constructed that will hole rock without striking blows. This enables machinery of the simplest and most ordinary character to be used, and thus avoids those special difficulties that the mechanic must face when he is driven to utilise a large power in the production of percussive action; moreover, machinery can be applied in places where a reciprocating motion, if admissible at all, would present peculiar difficulties—such as making a hole under water, or putting down deep holes where, from the circumstances of the case, the cutter must be at a great distance from the source of power.

The diamonds that are used are not valuable gems, but carbonate, a substance that till lately had no commercial value, and was first introduced for the purpose of cutting other diamonds. It comes from the Brazils in considerable quantities, and though it has not yet been discovered in the Cape diamond fields, it is more than probable that it exists there, and, indeed, wherever the diamond is found. You will see that its appearance is much like that of a piece of coal, or dull jet, and as unlike as it is possible to be to its brilliant sister, the ordinary diamond, though chemists tell us that the two are identical in composition. I presume that one is perfectly, the other imperfectly, crystallized; and if so, it is no doubt this very imperfect crystallization that gives to carbonate its value for my purpose, as it has no or next to no cleavage, and consequently does not split up and break in the way that a diamond or piece of boart would do. This last substance, of which I hold a sample in my hand, is an impure diamond, and would seem to stand half way between the brilliant and carbonate. According to the tables published in Ure's *Dictionary of Arts*, the following are the different specific gravities and degrees of hardness of some of the hardest stones:

Substance.	Hardness.	Sp. Grav.
Diamond from Ormus	20	3·7
Pink diamond	19	3·4
Blueish and yellowish	19	3·3
Ruby	17	4·2
Pale ditto from Brazil	16	3 5
Deep blue sapphire	16	3·8
Ditto paler	17	3·8
Topaz	15	4·2
Whitish topaz	14	3·5
Emerald	12	2·8
Garnet	12	4·4
Agate	12	2·6
Onyx	12	2·6
Quartz	10	2 7

Now, as there are plenty of corundum or rubies and sapphires in the market at mere nominal values as compared with those of carbonate, I thought they could be advantageously used in place of the latter, if only their hardness, as compared with the diamond, was anything approaching that which the tables led me to look for. On trying, however, both sapphires and corundum, I found the above proportions altogether wrong in point of hardness; they were nowhere near carbonate. The trial that I put them to was as follows: I set a piece of carbonate in a suitable holder, and held it against a grindstone; the carbonate turned the grindstone down. On trying the same experiment with the other minerals the grindstone wore them down. I am of opinion, therefore, that the diamond stands, in point of hardness or resistance to abrasion (if the two are not synonymous terms), at an enormous difference in advance of any other known material in nature, and this seems a most remarkable fact.

The application of the diamond to rock-drilling is worked out as follows: The stones are set in an angular ring, made of steel; they are fastened in by making holes as nearly as possible the size of the stones to be set, and then burying them, leaving projecting only the amount necessary to allow the water and debris of the cutting to pass; the metal is then drawn round the stone so as to close it in on every side, and give as large a bearing surface as possible to resist the tendency

* Read before the Iron and Steel Institute at Liege.

of the stone to be forced out. I may here say the loss from breakage and from the stones being torn out is far more serious than that from wearing; in fact, with good stones having good broad running faces, the mere wear is quite trifling. A stone breaking out is always a cause of damage to the others. The crown so set is attached to the end of a steel tube and kept rotating against the rock at some 250 revolutions per minute. Water is supplied through the hollow of the bar, whence it passes under the cutting face of the crown to the surface of the hole between the side of the latter and the outside of the boring tubes; the diamonds are thereby kept cool, and the debris from the cutting is washed away. The crown has to be kept pressed forward with a force depending on the nature of the rock to be cut, varying from 400 lb. to 800 lb., when the cutting is done at speeds ranging from 2 in. to 4 in. per minute. Granite and the hardest limestone are readily cut at 2 in. to 3 in. per minute; sandstones at 4 in.; and quartz at 1 in. per minute. These speeds can be increased at pleasure, but I give them as representing the rates at which the drills are ordinarily seen in practice.

On the table is a sample of pure emery, which was cut at the rate of 2 in. per minute, by a crown which I now hold in my hand; and which has bored through 6 in. of emery, 10 ft. of granite, and 95 ft. of hard sandstone; you will see that it is, so far as the diamonds are concerned, almost as fit for work as ever. The emery was cut out of a block put under the drill for experimental purposes, merely to show how great is the cutting power of the diamond. No rock is met with in mining that approaches emery in hardness, and, indeed, it would be a most difficult operation getting a hole put in without a diamond drill.

The cutters travelling in an angular ring, it follows that a solid core is produced, an arrangement which, while it insures a minimum of work being done to make a given-sized hole, affords evidence of the strata passed through, a fact which is invaluable for certain applications. Having explained the crown, and the way in which it cuts, I shall now describe the machinery for utilising it. 1. For prospecting—The drawings on the wall show two views of a prospecting machine, which are in all essential particulars the same as those now being used. The crown is screwed on to the end of steel tubes, which are successively lengthened as the hole is deepened, the bars pass through a quill, and are gripped by a universal clutch which causes them to turn. Set screws on the top of the quill steady them centrally at their upper ends; the quill is attached to a crosshead which slides between two vertical uprights, and weights are provided, working over pulleys, by which the weight of the boring rods and crosshead are either increased or balanced, when extreme depth of holes are reached. The water is supplied by a force pump passing to the hollow bars through the union at the top of the quill. The other gearing about the apparatus is for raising and lowering the rods by power. It consists of a crab, and the lifting is done by means of a chain or rope passing over a pulley attached to shear legs across the hole. Two descriptions of boring tubes are used, as shown by the sketch, one of which is more expensive than the other, but is stronger, and at the same time, being nearly flush on the outside, there is less risk of the rods jamming in the hole. Suitable tackle is provided for recovering the tubes when they break, and their hollow form makes them peculiarly easy to get hold of. It very rarely happens that any are permanently lost. The usual plan for lifting them is a taper tap which enters into the hollow, when a few turns suffice to get a firm grip.

TO BE CONTINUED.

THE ESTEY ORGAN.—Messrs. J. Estey & Co., makers of the Cabinet Organs which bear their name, are well known to have had wonderful success in obtaining sweetness amd strength of tone. Their cottage organs are found all over the country, and it is undoubtedly due to the excellence of work like theirs that much of the popularity of these instruments is due. Only a few years ago the house organ was unknown except to amateurs, for it was nothing more than a dwarfed church organ, and was incapable of answering the needs of ordinary home use. But through the efforts of such makers as the Messrs. Estey the organ has not only been very much improved, but it has had its character completely altered. No longer confined to churches, it has won the best opinion of the people, and, as we said, is found in homes all over the country. Variety and volume of tone and sweetness are obtained from an instrument surprisingly diminutive in size, but strongly and handsomely made.

MINING SUMMARY.

Colorado.

From the Mt. Lincoln *Sentinel* of Sept. 4.

HALL GULCH MINING ITEMS.

The Comet lode shows a six foot crevice, six inches of galena, A tunnel 40 feet in length is driven to cut this and two other lodes, by cross cuts. The tunnel is five feet wide at the top, and six on the bottom, and is well timbered. A blacksmith shop has been built adjoining the tunnel. Eleven men are at work on this mine.

The Madagascar lode has a tunnel twenty feet in length. The crevice is five feet wide. Ore has just been struck in the tunnel; it is ten inches wide and consists of galena and copper pyrites.

The Leftwick lode carries from a foot to eighteen inches of mineral, galena and copper pyrites, has a tunnel eighty feet in length, but has not reached the vein. As soon as it is found four levels will be immediately run on the lode. The boarding house built on this lode, accomodates twenty-four men, and they are employed on the mine.

The Whale lode has a crevice four feet in width, with from one to two feet of mineral, galena and gray copper, and assays from 100 to 1,500 ounces. Four levels have been run on this mine. The lower level has been run 65 feet, but will be pushed 700 as fast as possible. The one next above, (250 feet,) has been driven thirty feet. The next level is seventy-five feet above the one last mentioned. The upper level, seventy-five feet above, has been driven sixty feet. A splendid house, blacksmith shop, etc, have been built, and sixteen men are at work on the mine.

The Tecumseh lode has a shaft sixteen feet deep, which shows a seven foot crevice, carrying fifteen inches of mineral, that runs well.

The Cold Spring lode, course north and south, has a ten foot crevice, carrying two feet six inches of galena, assaying from 100 to 1,500 ounces, has several shafts sunk on it, the deepest fifteen feet.

All the above work has been done by Messrs. Hall & Jebb since the 21st of last June, and reflects great credit on both them and their able and efficient foreman, Mr. Bartolett. We challenge any mining community to show as much for the same length of time.

Last March there were but two cabins in the gulch, now there are at least sixty good buildings and cabins. Col. Hall has a very fine residence, and Mr. Brownell has a large well filled store. There is a very good boarding house—owned by the company. The finest saw-mill in the Territory, which saws from twelve to fifteen thousand feet of lumber per day. Mr. E. L. Chamberlain has charge of the mill, and it bears the impress of his ability.

Advertisements.

The special advantages of the ENGINEERING AND MINING JOURNAL, *as a medium for advertisers, are so great and so widely known that it may seem almost needless to call attention to them. It is extensively circulated among the engineers of the country and takes a position in this respect before any other publication of the kind. It has a large and constantly increasing circulation among miners and mine owners, and men connected with mining operations generally. As it is the only paper in the country that makes this subject a specialty it has this field entirely to itself, and is the only direct and reliable means of reaching this class of persons. Being kept on file by almost every subscriber, it is doubly valuable as a permanent means of keeping an advertisement before the public. It is the Organ of the* AMERICAN INSTITUTE OF MINING ENGINEERS, *and is regularly received and read BY ALL THE MEMBERS AND ASSOCIATES of that large and powerful society.* THE ONLY ONE OF THE KIND IN THIS COUNTRY. *It is therefore the best medium for advertising all kinds of machinery, tools and materials used by engineers or their employees. It is the recognized organ of the coal trade, and is taken extensively by the trade throughout the country, and presents the very best means of reaching that very important class of men.*

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Nov. 21-1y

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JOHN JEWETT & SONS, AGENTS, 182 FRONT STREET, NEW YORK.

OXIDE OF ZINC, SPELTER, SHEET ZINC.

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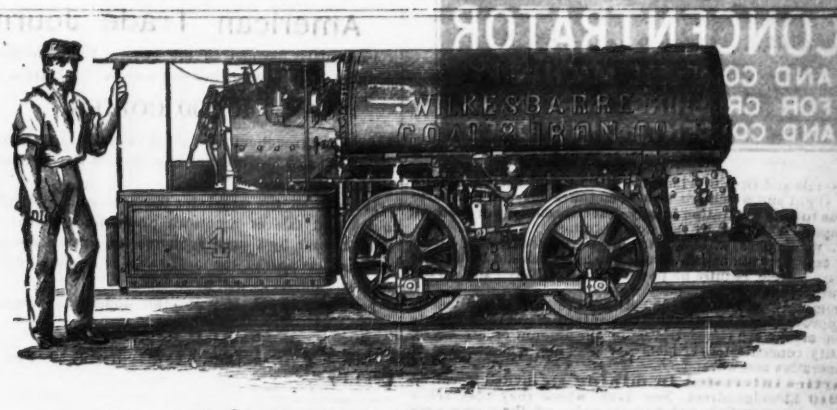

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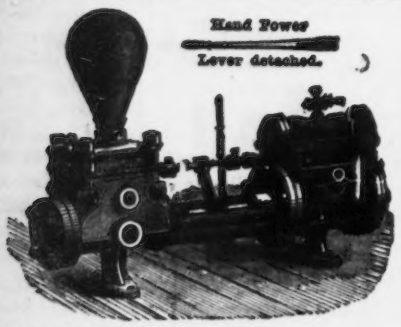

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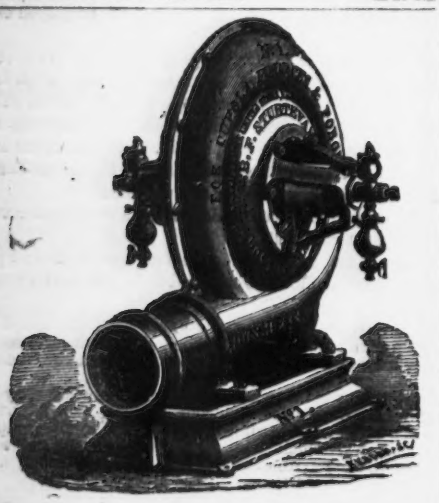

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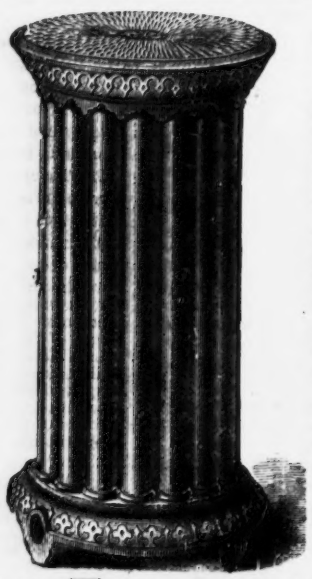

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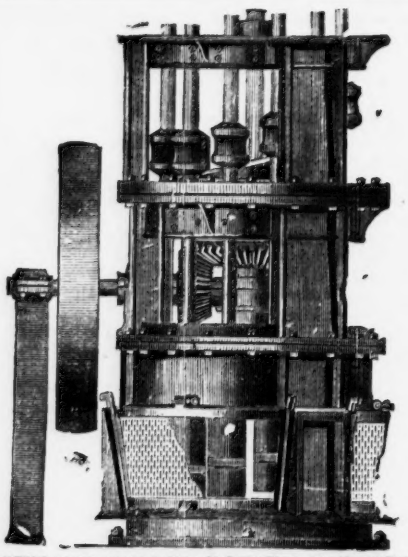

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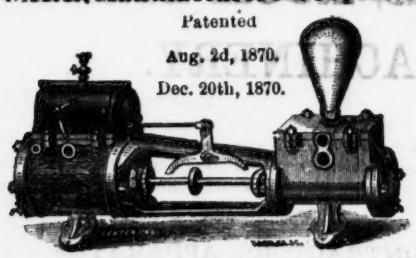
STEAM PUMP

A. CARR, Manufacturer & Proprietor.

Patented

Aug. 2d, 1870.

Dec. 20th, 1870.



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It is unsurpassed. Also,

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May 27-Sept. 10

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EXECUTED AT THE OFFICE OF

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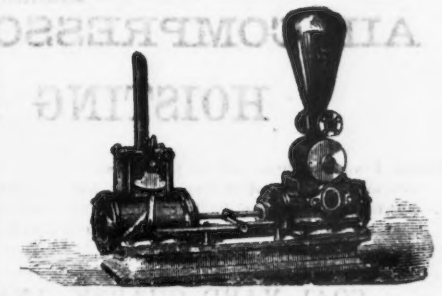

This Pump has taken the first premium at every Fair in the United States where there has been a practical test.

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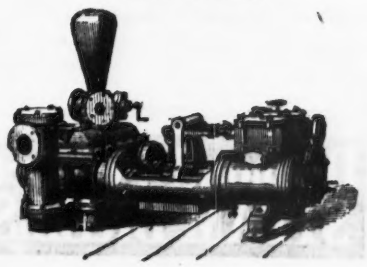

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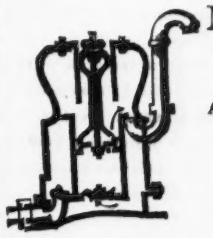

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Patent Fly Wheel

STEAM PUMP,

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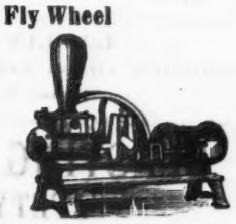
COMBINED.



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Nov. 19:1y

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AIR COMPRESSORS, ROCK DRILLS
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HOISTING MACHINERY.

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Yours, etc., WM. WISEMAN, Superintendent.

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FRICTION OR GEARED MINING AND QUARRY HOISTERS.
For Hoisting and Conveying Material to any Distance by Wire Cables.
Smoke-burning Safety Boilers. Oscillating Engines, Double and Single, ½ to 100 horse-power. Centrifugal Pumps, 100 to 100,000 gallons per minute. Best Pumps in the world; pass mud, sand, gravel, coal, grain, etc., without injury.
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Recent improvements in connection with the celebrated LESCHOT'S patents have increased the adaptability of these drills to every variety of ROCK DRILLING. Their use, both in this country and in Europe, has sufficiently established their reputation for efficiency and economy, over any other now before the public.

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BLASTING POWDER,
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wherever required, from having nine manufactories in different States, beside agencies and magazines at all distributing points. nov. 1:1y

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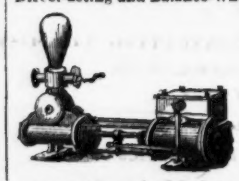
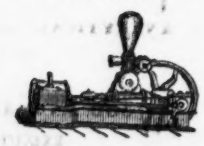
GUILD & GARRISON,
manufacturers of Steam Pumps for all purposes, both Direct-acting and Balance-Wheel.

For sale at the Steam Pump Works, 34 to 44 First street, Williamsburg, N. Y. 1y

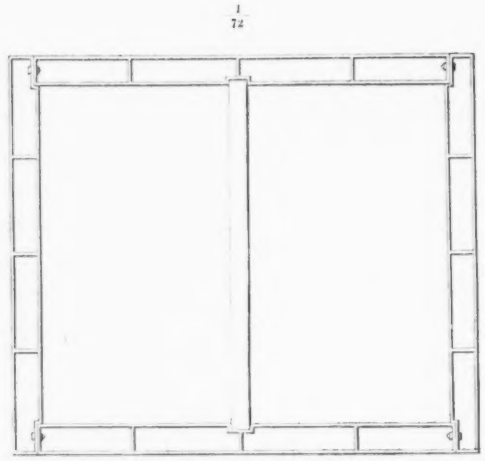
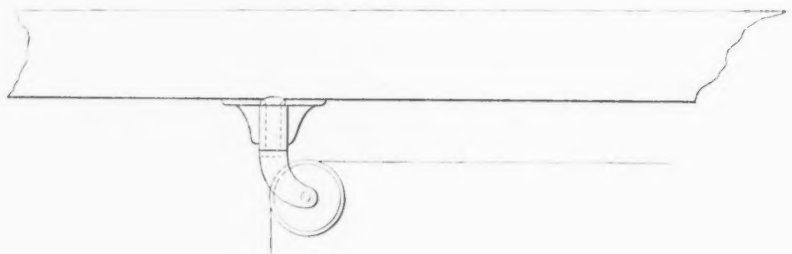


Fig. 14.



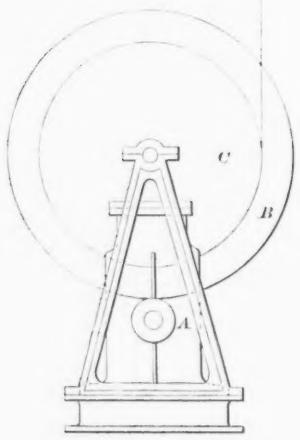
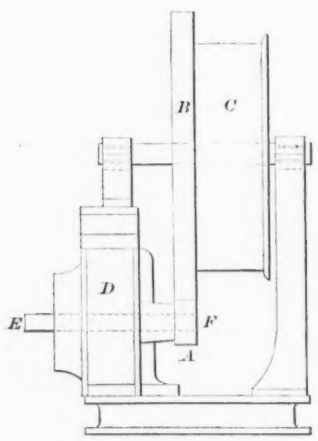


Fig. 18.



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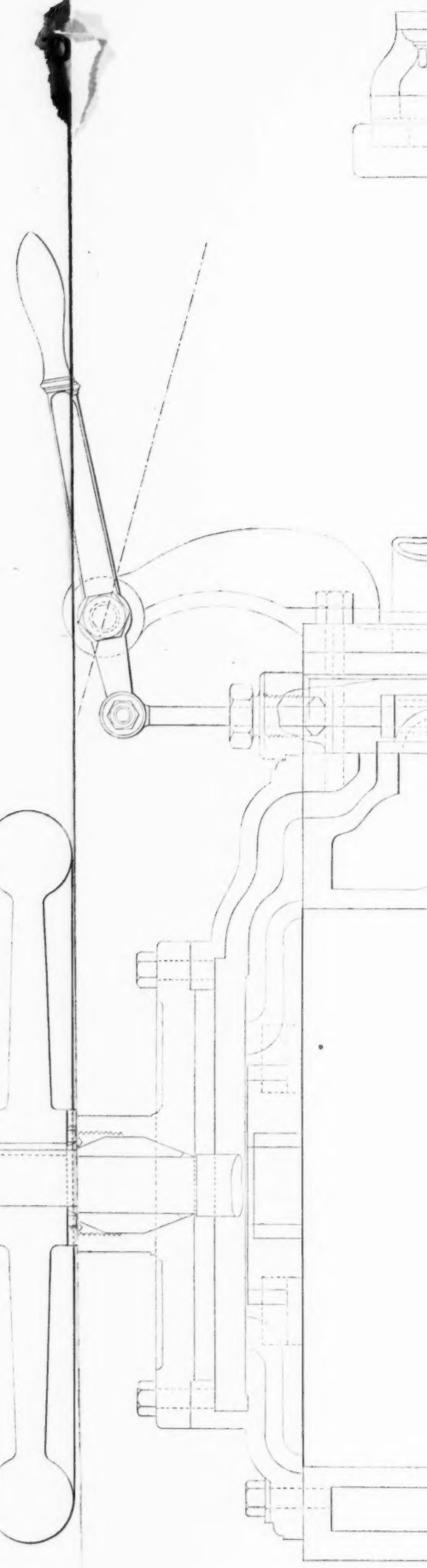
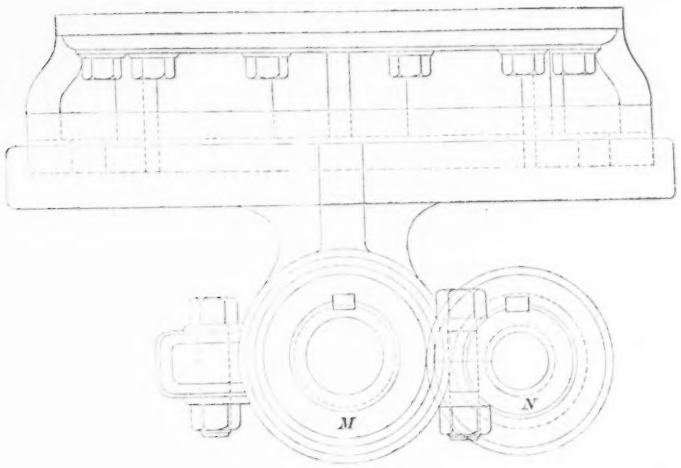


Fig.



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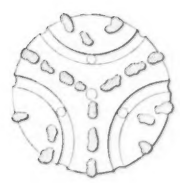
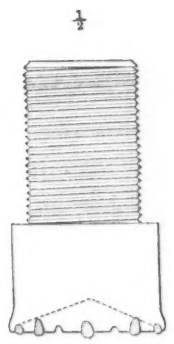


Fig. 11.



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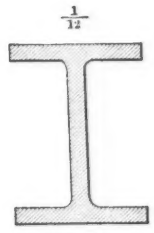

Fig. 13.

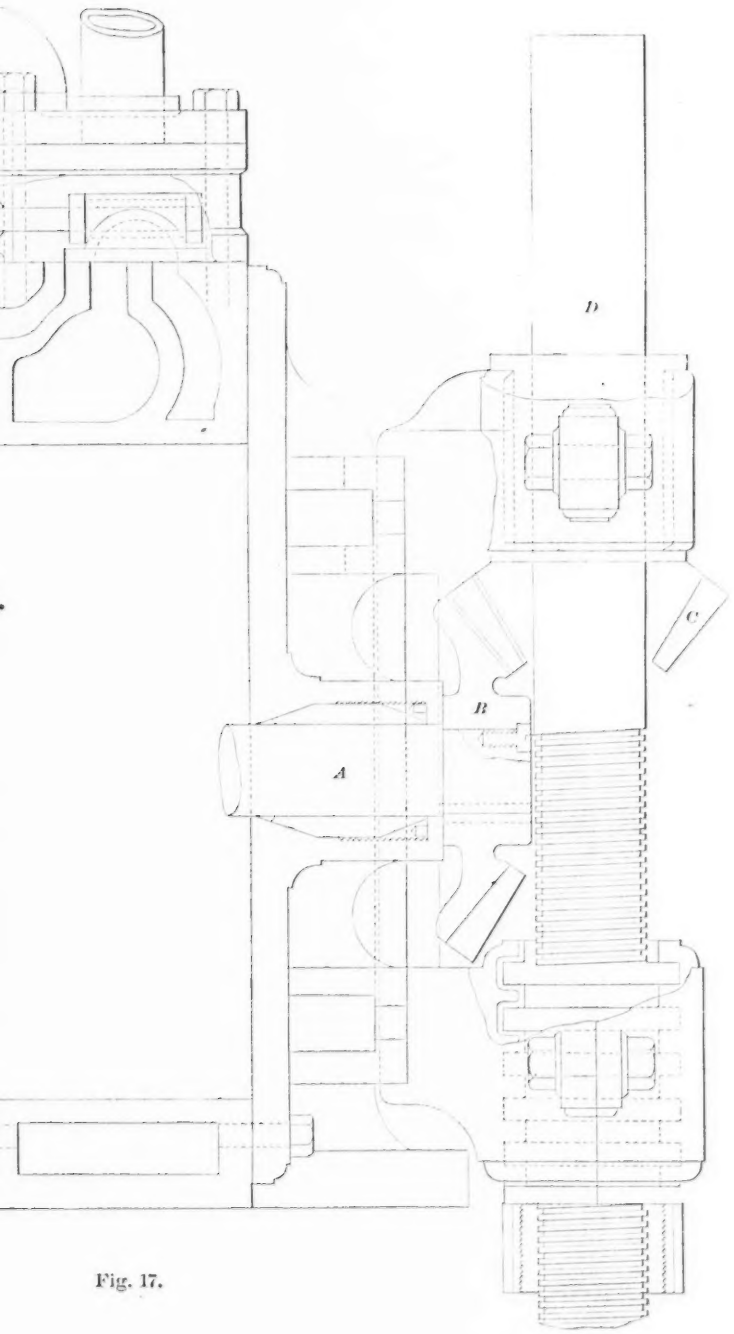

Fig. 17.

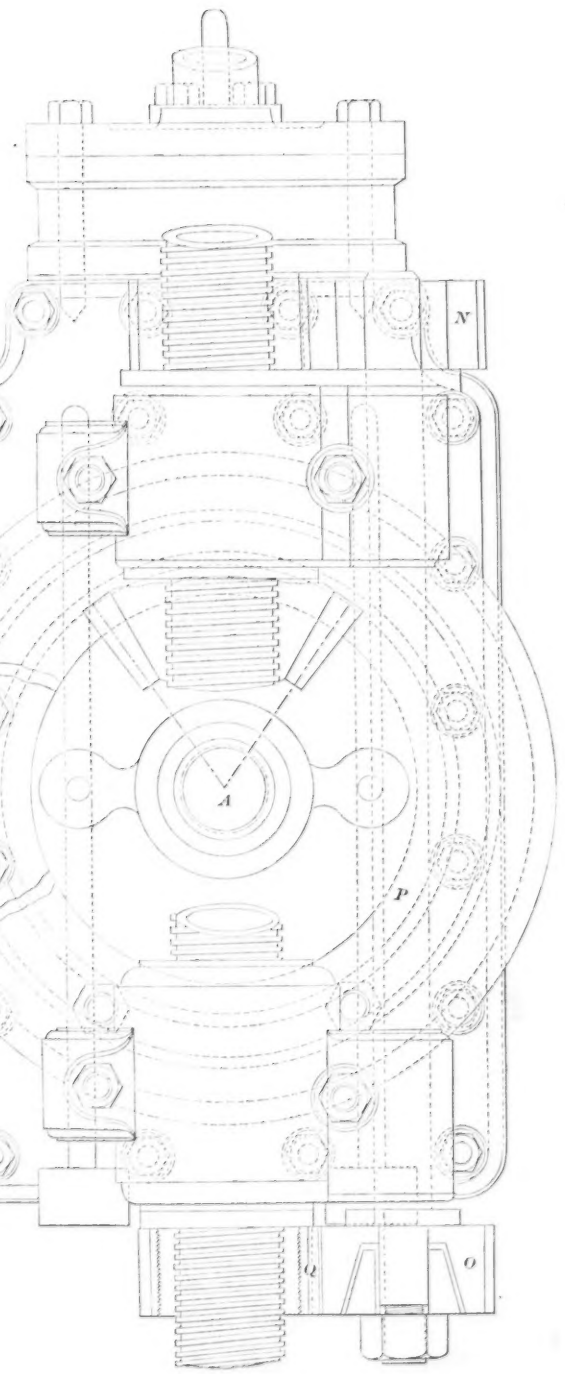

Fig. 16.